ECHNOLOGY DEPT
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DETROIT

Construction Methods and Equipment

McGraw-Hill Publishing Company, Inc.

February, 1939

Price 20 Cents

ROAD BUILDERS NUMBER

Public Relations For Highway Department

$60,000,000 Turnpike

Mechanical Drag Float For Smooth Concrete

Monolithic Brick Vibrated

Heavy Grading

Soil-Cement Road

Asphalt Finisher

Superhighway

Road Mix Machine

Employee Relations for Contractors

CALIFORNIA'S REALIGNMENT of Los Gatos-Santa Cruz state highway involves heavy grading with tractor-scraper outfits. Job involving 2,200,000 cu. yd. of cut and fill costs $180,000 per mile.

Another Smaller Northwest

for Daniel O'Connell's Sons, Inc. HOLYOKE, MASS.

WHEN you make a major investment for a tool like a shovel, crane or dragline, you want to be positive that it has the features, and dependability that will earn money.

Month after month, year after year we have told you about the many users that buy Northwest again and again—not one company—not only large outfits—but every class of contractor in the country.

Here is Daniel O'Connell's Sons, Inc., of Holyoke, Mass. This progressive contracting firm is known all over the east. They have used Northwests since 1925.

They have found the answer to their shovel, crane and dragline problem—the answer you are looking for—lower maintenance and higher output because of Northwest advantages. If you have never owned a Northwest you should find out what a Northwest can do for you. If you never have investigated a Northwest you owe it to yourself to learn more about them.

What capacity do you need? We will be glad to send complete details.

NORTHWEST ENGINEERING CO., 1727 Steger Bldg., 28 E. Jackson Blvd., Chicago, Ill.

NORTHWEST

Shovels • Cranes • Draglines • Pullshovels • Skimmers

TECHNOLOGY DEPT.

CURRENT JOBS

. . . . and Who's Doing Them

HIGHWAYS

Recent highway contracts awarded included the following: Pennsylvania: 6.7 mi. of new turnpike, $605,114, to **Connell & Laub.** of Dayton, Ohio; dual type paving and concrete bridge in Butler County, $474,648, to **York Engineering & Construction Co.**, of York, Pa.; grade separation in Pittsburgh, $346,753, to **W. F. Trimble & Sons Co.**, of Pittsburgh. Ohio: 3.6 mi. in Cuyahoga County, $362,331, to **Baldwin Bros.**, of Cleveland; 3.3 mi., Pike County, $305,982, to **Purdy Construction Co.**, of Mansfield, Ohio; 3.6 mi. in Scioto County, $404,369 to **S. Monroe & Sons Co.**, of Portsmouth, Ohio. Mississippi: 12.8 mi. in Webster County, $316,901, to **West Construction Co.**, of Chattanooga, Tenn.; 10.4 mi. in Alcorn County, $276,074 to **Kile Killman**, of Salem, Ind.; 15 mi. in Noxubee County, $285,884, to **H. E. Wolfe Construction Co.**, of St. Augustine, Fla. Michigan: 9.8 mi. in Mecosta County, $222,536, to **Bridgeport Core Sand Co.**, of Saginaw, Mich. New York: 8.3 mi. in Delaware County, $565,622, to **Mohawk Paving Co., Inc.**, of Buffalo; 10.2 mi. in Warren County, $598,898, to **Callahan Road Improvement Co.**, of South Bethlehem, N. Y. Illinois: 7.4 mi. in De Witt County, $226,736, to **R. McCalman, Inc.**, of Danville, Ill. Arizona: Improving highway, Mojave County, $209,780 to **Tanner Construction Co.**, of Phoenix. Texas: 9.9 mi. in Colorado County, $206,210, to **Briggs-Killian**, of Pharr, Tex. Indiana: 3.2 mi. Vigo County, $266,340, to **Mid-West Construction Co.**, of Chicago.

DAMS

Low bid of $18,916,650 for sections of tunnel for New York City's Delaware River aqueduct in Ulster County, N. Y., was submitted by **Samuel Rosoff, L'td.**, of New York City. Award of contract for another portion of New York's Delaware River aqueduct tunnel went to **Frazier-Davis Construction Co.**, of New York City and St. Louis, Mo., for $11,924,450. The Metropolitan District Water Supply Commission of Boston, Mass., let one contract for concrete pressure pipe to the **Lock Joint Pipe Co.** of Ampere, N. J., for $4,164,126, and another contract for pressure aqueduct forming Southboro tunnel to **West Construction Co.**, of Boston, for $3,197,015. At Los Angeles, Calif., the Metropolitan Water District awarded contract for Palos Verdes reservoir to **W. E. Hall**, of Alhambra, Calif., for $588,960. In Tacoma, Wash., successful bidder for concrete pipe for water supply was **American Concrete & Steel Pipe Co.**, of Tacoma, with tender of $207,045. Waterworks and sewer improvements in Temple, Tex., went to **Williams & Whittle**, of Dallas, Tex., for $209,324. Filter building in Rome, Ga., is being built by **Hardaway Contracting Co.**, of Columbus, Ga., for $148,800. A bid of $103,800 obtained pipe line and filter plant job in Mena, Ark., for **Ottinger Bros.**, of Hinton, Okla. Waterworks improvements in Big Spring, Tex., are under way by **E. L. Dalton**, of Dallas, Tex., at cost of $235,597.

Mahoning dam near Pittsburgh, Pa., U. S. Engineer Dept. project, was bid in for $2,646,610 by **Dravo Corp.**, of Pittsburgh. **Brooker Engineering Co.**, of Detroit, Mich., received a $575,440 contract for substation at Grand River dam near Vinita, Okla. For dam and siphons of Broadwater-Missouri project at Toston, Mont., low bid of $528,568 was received from **J. C. Boespflug**, of Miles City, Mont.

SUBWAYS

Contracts for sections of new subway for Chicago, Ill., were awarded as follows: $2,746,104 to **Herlihy Midcontinent Construction Co.**, of Chicago; $2,445,666 to **M. J. Boyle Co.**, of Chicago.

BUILDINGS

Public — For Hunter College building, New York City, bid of $2,329,000 by **Psaty & Fuhrman, Inc.**, of New York, was low. Superstructure for hospital in suburb of Denver, Colo., will be built by **Great Lakes Construction Co.**, of Chicago, for $2,985,505. Successful bidder for $1,004,000 college dormitory at Ann Arbor, Mich., was **J. A. Utley**, of Detroit, Mich. Metropolitan Housing Authority in Toledo, Ohio, has let $1,440,943 contract to **A. Bentley & Sons Co.**, of Toledo. Veterans' home at Rocky Hill, Conn., went to **F. H. McGraw & Co.**, for $1,400,000. In New York City, **Bethlehem Steel Co.** obtained $1,343,100 contract for structural steel in new Criminal Courts building. Veterans building in Dallas, Tex., to cost $843,700, is under construction by **R. McKee**, of El Paso. **MacDonald Building Co.**, of Tacoma, Wash., is constructing state office building in Olympia, Wash. Institutional building at Bethesda, Md., went to **C. H. Thompkins Co.**, of Washington, D. C., for $1,386,100. Work is under way on $1,584,000 court house for Nassau County, Mineola, N. Y., by **P. J. Carlin Construction Co.**, of New York City. **New England Concrete Co.**, of Providence, R. I., has a $518,300 contract for a police and fire station in that city. In Kalamazoo, Mich., **Pearson Construction Co.**, of Benton Harbor, Mich., has a $483,000 hospital contract.

Commercial — Housing project at Stamford, Conn., to cost $2,500,000 was awarded to **C. Newmark**, of New York City. In Baltimore, Md., **A. Lloyd Goode Co.**, of Washington, D. C., is engaged on a $2,000,000 apartment housing project. Successful bidder for $755,000 apartment in Washington, D. C., was **Stone & Warwick Construction Co.**, local contractor. A $700,000 department store is being built in Los Angeles, Calif., by **Ford J. Twaits Co.**, of Los Angeles. A $9,500,000 contract for a power plant at Oswego, N. Y., went to **Stone & Webster Engineering Corp.**, of New York City.

Road Builders' Number

This issue of CONSTRUCTION METHODS AND EQUIPMENT, appearing on the eve of the convention of the American Road Builders' Association in San Francisco, is devoted mainly to highways.

Succeeding issues, of course, will deal with other types of construction. — EDITOR.

Construction Methods and Equipment

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FEBRUARY, 1939

ROBERT K. TOMLIN, Editor
A. E. PAXTON, Manager

A McGRAW-HILL PUBLICATION

Editorial Staff: Vincent B. Smith, Paul Wooton (Washington), Nelle Fitzgerald

The "How" of it

For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

How ROLLING GANTRY CRANE handled materials on long floodway bridge. — p. 33
How PLEASANT PUBLIC RELATIONS resulted from frank and friendly policies of California Division of Highways. — p. 36
How RIGHT-OF-WAY NEGOTIATIONS avoided friction with property owners. — p. 38
How ELECTRICAL CONTROL helped boost output of proportioning plant for concrete pavement. — p. 41
How BRICK VIBRATING MACHINE embedded paving brick in fresh concrete base and removed surface irregularities. — p. 44
How GRADING EXPERIENCE on Blue Ridge Parkway developed standardized plant for this work. — p. 45
How STRAP-AND-PIN JOINT for timber structures worked equally well in tension or compression. — p. 49
How CRAWLER MOUNTING enabled carrier scrapers to transport loads over soft mud. — p.49
How HARROWS, PLOWS AND CULTIVATORS performed important operations in soil-cement road construction. — p. 50
How TAMPING FINISHER equipped with heated screed laid thin sheet asphalt on old pavement. — p. 56
How ABANDONED RAILROAD PROJECT provided location for low-gradient express highway crossing mountains. — p. 58
How TRAINING OF EMPLOYEES in diversity of occupations tended to improve stability of organization. — p. 63
How RUBBER-TIRED WHEELS were substituted for crawler trucks on earth-moving wagons. — p. 65
How PULVERIZED CLAY was worked into sandy oil to provide stabilized subgrade. — p. 65
How STABILIZED GRAVEL BASE was compacted under traffic prior to application of bituminous mat. — p. 66
How DETACHABLE DRILL BITS gained wide popularity among construction men. — p. 67
How BELT ATTACHMENT at rear of pugmill-type road-mix machine increased unit's capacity. — p. 68
How MECHANICAL DRAG FLOAT produced smooth concrete pavement. — p. 72
How TRACTOR-DRAWN SCRAPERS moved shale on highway grading project. — p. 76
How BONUS PAYMENTS eased burden of seasonal unemployment. — p. 96

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JAMES H. McGRAW, Founder and Honorary Chairman

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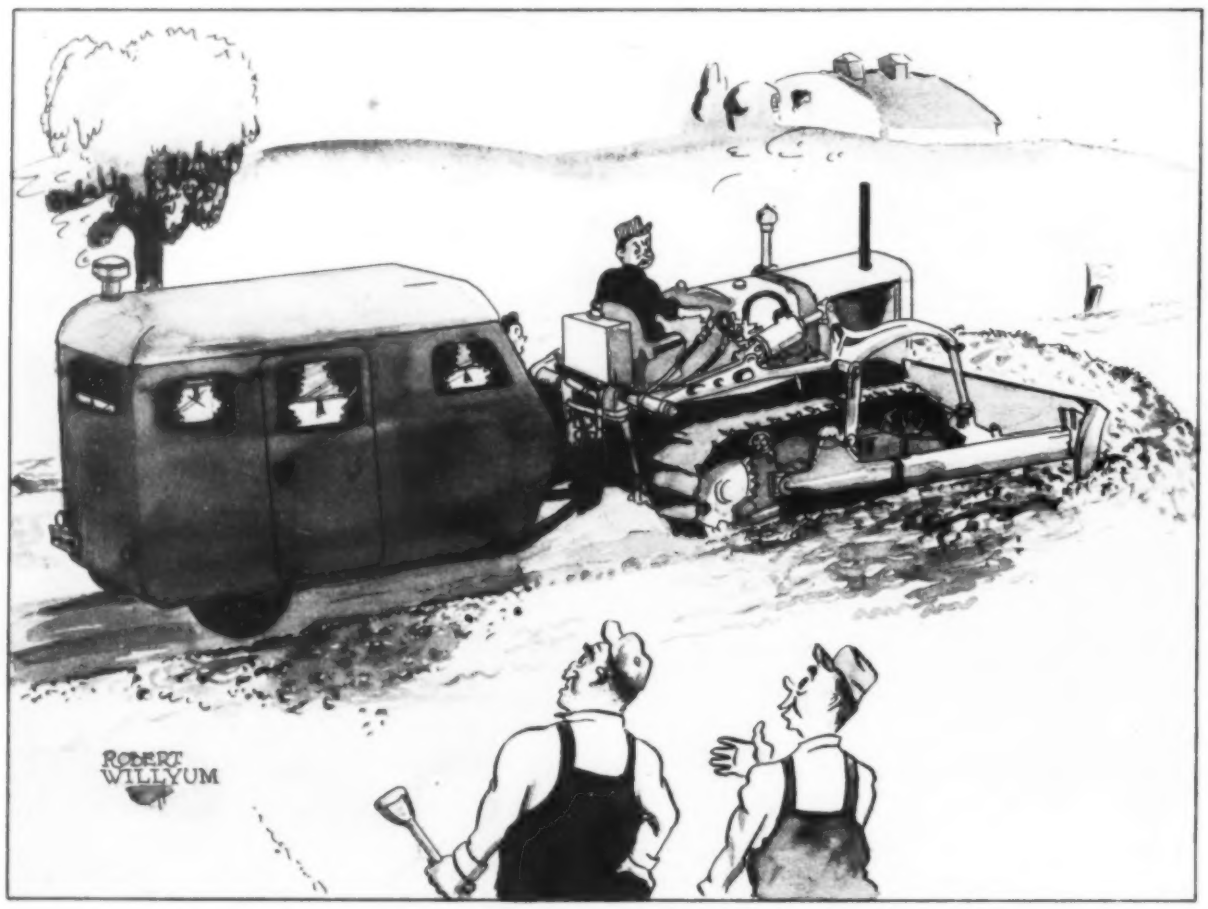
"Heh! Heh! So those were only wrinkles in the blueprint— the joke's on me, boss!"



"His wife doesn't trust him!"

CARONDELET BUILDING
910 GRAVIER STREET
NEW ORLEANS
RESULT OF TESTS
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PWA La
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Wogan & Bernard-B. R. Alford-J. B. Ryan
ification - 3000 CONCRETE CYLINDERS
DATE MADE
TESTED
AGE DAYS
LBS
SLUMP IN.
S/U RATIO
X SECTIONAL AREA
TOTAL LOAD
PSI
LOCATION OF JOB
10/28 10/30 3 142.85-3.92 4 6.0 28.27 87500 3095 Floor Slab
10/27 10/30 3 " " " " 83500 2953 "
10/27 11/1 4 " " " " 88000 3112 "
10/28 11/1 4 " " " " 90000 3183 "
10/28 11/1 3 " " " " 83500 2953 "
10/29 11/1 3 " " " " 86000 3042 "
SPECIFICATIONS FULLY MET.
SHILSTONE

"SPECIFICATIONS FULLY MET"

A LITTLE extra care in figuring a job often means a worthwhile cash saving. Take the new Terrebonne Parish Courthouse, Houma, La.; Wogan & Bernard, architects; P. C. Kuhn, engineer, both of New Orleans.

Caldwell Bros. & Hart, New Orleans, contractors, figured this job with both Lone Star Cement and 'Incor' 24-Hour Cement. Specifications called for 3000-lb. concrete at 28 days; form removal in 48 hours with 'Incor'; otherwise 21 days. 'Incor' showed a clear-cut saving on floors, walls and roof; one-third less forms and a 30-day saving on job overhead. Lone Star figured cheaper for footings. So that's the way the job was built.

Does it pay to figure with both cements? Fact is, a 30-day time saving, as in this job — at $35 to $75 a day job overhead, depending on location and conditions — means $1050 to $2250 on this item alone!

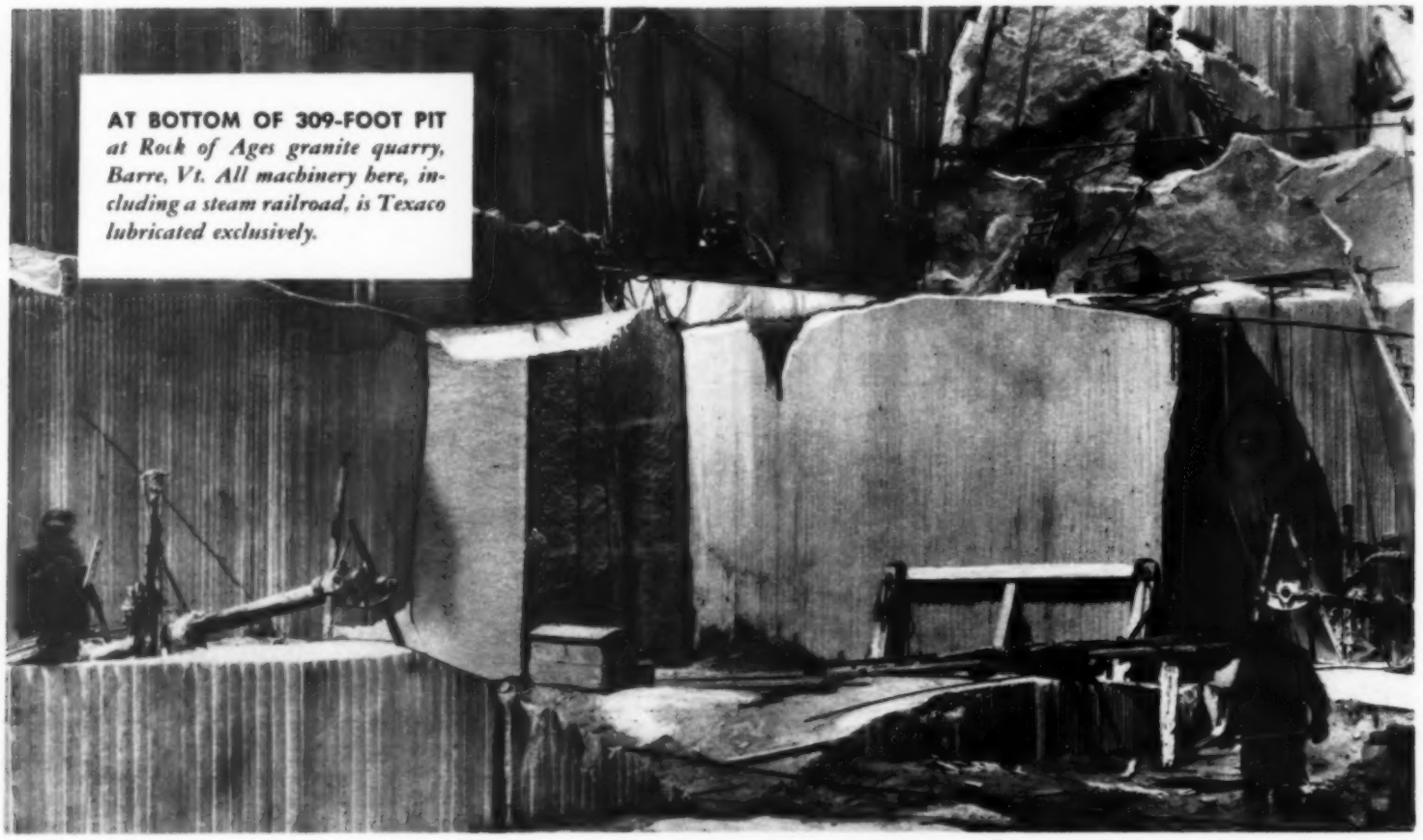
Now, as to quality: *Test results (above) show that 'Incor' produced the 28-day design strength in 3 to 4 days.* "Specifications Fully Met" tells the story of *dependable* early strength. Just as 'Incor's 11-year service record tells of ultimate strength and durability.

Use 'Incor'* where early strength and faster job curing show you a profit. Elsewhere, use Lone Star, quality standard for over a quarter century. Write for copy of new book entitled "Cutting Concrete Costs." Lone Star Cement Corporation, Room 2262, 342 Madison Ave., New York. *Reg. U. S. Pat. Off.

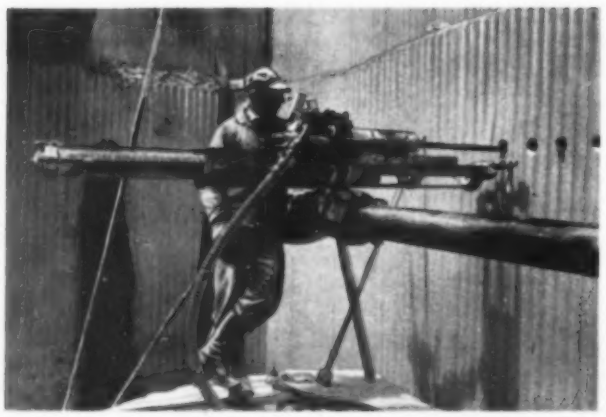
LONE STAR CEMENT CORPORATION

MAKERS OF LONE STAR CEMENT · · · 'INCOR' 24-HOUR CEMENT

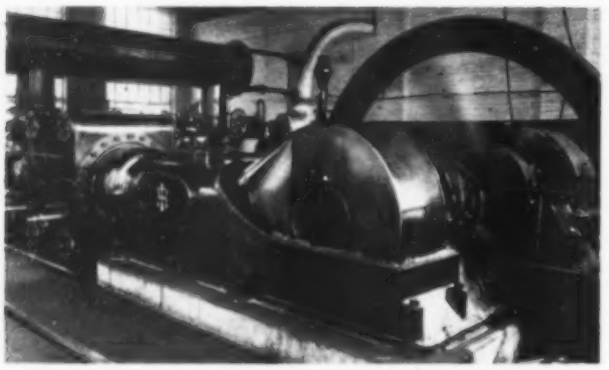
Worlds' largest MONUMENTAL GRANITE QUARRY



AT BOTTOM OF 309-FOOT PIT *at Rock of Ages granite quarry, Barre, Vt. All machinery here, including a steam railroad, is Texaco lubricated exclusively.*



MORE THAN 70 AIR TOOLS *are chipping their way into deep granite here. Tough service, but Texaco helps to keep them on the job.*



ONE OF THE I-R AIR COMPRESSORS *which have a capacity of 9,000 cu. ft. a minute. All are Texaco lubricated.*

A Texaco User For 14 Years

Rock of Ages Supt. W. R. Reilly who knows—and gets—his Texaco Lubricants from Mr. W. G. Reynolds of Reynolds & Son.

OPERATING THE COUNTRY'S LARGEST granite quarry at Barre, Vt., the Rock of Ages plant is extensive and very efficient. Granite is hard and heavy. ★ Throughout this property, whether it be drills, compressors, motors, hoists, or their steam railroad, all lubrication for 14 years has been TEXACO. ★ 2186 warehouses make Texaco available to everybody. Texaco engineers will help you select and apply. To order, phone locally or write: The Texas Company, 135 East 42nd St., New York City.

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Texaco Dealers invite you to tune in The Texaco Star Theatre — Every Wednesday Night — Columbia Network — 9:00 E. S. T., 8:00 C. S. T., 7:00 M. S. T., 6:00 P. S. T

Convincing Evidence of Trac-Truk Performance!

THESE "1938" JOBS PROVE NATION-WIDE PREFERENCE

Fresno Dam, Havre, Montana
Wachter, O'Neil & Megarry Bros.

Vallecito Dam, Bayfield, Colo.
Martin Wunderlich Co.

Boca Dam, Boca, California
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Lackawack Dam, Lackawack, N. Y.
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Pensacola Dam, Vinita, Oklahoma
Sammons-Robertson Co.

Salt Plains Dam, Jet, Oklahoma
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Wappapello Dam, Wappapello, Mo.
Porter-DeWitt Construction Co.

Sardis Dam, Batesville, Miss.
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Guntersville Dam, Paint Rock, Ala.
Tennessee Valley Authority

Arkport Dam, Arkport, N. Y.
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Whitney Point Dam, Whitney Point, N. Y.
The Hunkin-Conkey Construction Co., and Sholner, Gordon & Hinman

Tionesta Dam, Tionesta, Pa.
S. J. Groves & Lundin Brothers

Crooked Creek Dam, Kittaning, Pa.
Geo. M. Brewster & Son, Inc.

Fort Supply Dam, Woodward, Oklahoma
Morrison-Knudsen Co., Inc. and W. C. Cole

Keystone Dam, Ogallala, Nebraska
Minneapolis Dredging Co.-Martin Wunderlich Co.

Nevada Creek Dam, Avon, Montana
J. L. McLaughlin

Grassy Lake Dam, Ashton, Idaho
S. J. Groves and Lobnitz Bros.

Little Boulder Dam, Darby, Montana
Frank J. Haas

Cucolo Construction Corp.—Model F 10-Yard Rear Dump units — New York State Parkway.

Fresno Dam . . . 7 Model FDT 12-yard capacity Bottom Dump units

ESTIMATE YOUR 1939 WORK ON TRAC-TRUK COSTS . . . *They Increase the Profit Margin*

THE EUCLID ROAD MACHINERY CO.
CLEVELAND, OHIO U. S. A.
BRANCH OFFICE: 185 EAST BUTLER AVENUE, MEMPHIS, TENN.

EUCLID
THE PIONEER

CONTRACTS ARE BEING AWARDED

ON THE STRENGTH OF NEW EQUIPMENT.

MODERNIZE with MARIONS FROM 3/4 CU. YARDS UP

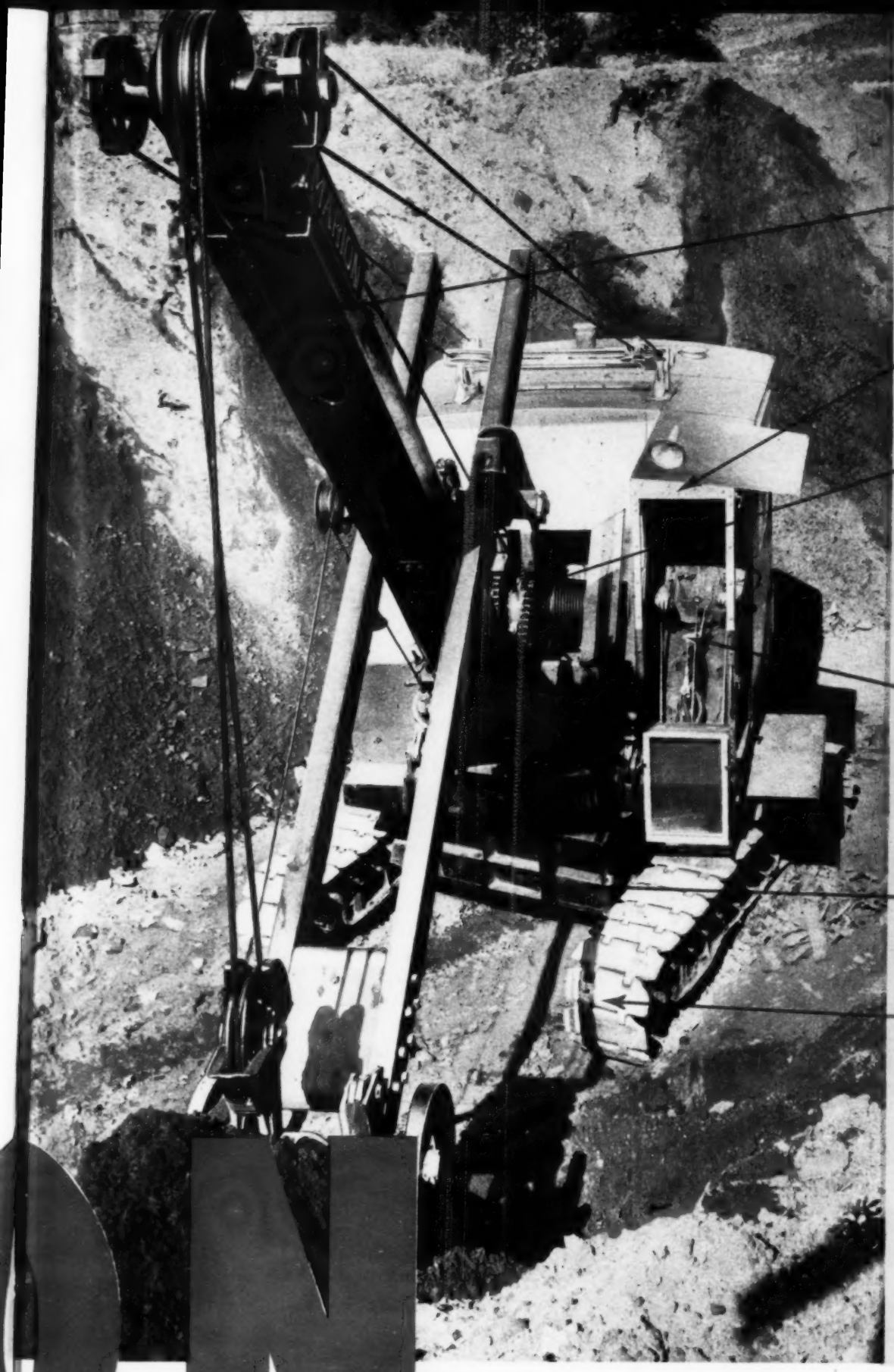
FAST

BASE YOUR BIDS ON THE GREATER YARDAGE and LOW OPERATING COST of THE NEW

MARI

There is a Marion excavator of the right size, type and capacity . . . from ¾ cubic yard up . . . to speed up the work on any material handling job . . . powered with either gas, Diesel, electric, gas-electric or Diesel-electric. Have our excavating engineers study your material handling requirements and make a recommendation.

THE MARION STEAM SHOVEL COMPANY • MARION, OHIO, U. S. A.



STURDY

BOOM-Sturdily constructed of steel to withstand all stresses incident to heavy digging. » » »

CAB-Full vision with many comforts and conveniences for the operator as a safeguard against fatigue. » »

UPPER FRAME AND OPERATING MACHINERY-Upper frame is a firm, solid foundation designed for maximum strength and lowest possible weight. The operating machinery is compactly arranged for ready accessibility, ease of maintenance and operation. » »

CONTROLS-All centrally located at operator's station. Starting, controlling and indicating devices within easy reach and sight of operator. Simplified manipulation of levers and foot pedals. » »

LOWER FRAME-Sturdily constructed for strength; long and wide base for stability. » » »

CRAWLERS-Positively will not clog in any material . . . nor bind in traveling over uneven surfaces. » »

ANTI-FRICTION BEARINGS-At all strategic points to reduce wear to a minimum. Propelling gears sealed against dirt and operate continuously in oil.

Write for bulletins of the Marion excavators in which you are particularly interested. Give size. Marion would also like to send you THE GROUND-HOG regularly with its compliments.

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VERSATILE

"PAY DIRT" ... YOU HAVEN'T BEEN HAULING

Walking right up-hill with an 18-ton load, a Euclid Trac-Truk on the Cajalco Dam project in California. Highly stressed parts of this 26,700 lb. unit are Nickel alloy steels.

...another instance of NICKEL'S help to construction equipment

COULD 20 of your units move 3,200,000 cu. yds. of earth in 151 working days—averaging 47 yards per unit per hour? Could you truck ore from an open pit mine at lower cost than laying rail trackage? These are actual records* of operators using Euclid Trac-Truk equipment—equipment using Nickel alloy steels in highly stressed parts.

Trac-Truk bottom-dumping, earth hauling equipment, made by the Euclid Road Machinery Co., Cleveland, both carries and trails 15 yard loads averaging 18 tons. To move so much "pay dirt" at high speed and low cost requires the help of alloy steels toughened with Nickel.

Nickel, by raising resistance to shock and fatigue, by minimizing distortion and abrasion, reduces weight and operating cost of heavy equipment. With Nickel alloy steels at all important points, operations can be speeded up and break-downs avoided. To make hard jobs easy, specify equipment strengthened with Nickel.

*Performance records of Euclid Trac-Truk units at New York World's Fair and in the Mesabi Range iron mines.

Euclid Trac-Truks "can take it" with these vital parts of Nickel alloy steels

Transmission-differential gears, drive pinions, SAE 2315, carburized and hardened to Brinell 601.

Front axle drop forged from SAE 3140.

Beam and knuckle, SAE 3135 heat treated to Brinell 300.

Stub axles, Nickel-chromium steel, heat treated.

Rear axle units, SAE 2515.

Axle shafts, SAE 3240 heat treated to Brinell 321-363.

Internal ring gear, SAE 3140 heat treated, Brinell 280-328.

Planetary gears, SAE 2315 carburized and hardened.

Timken roller bearings use Nickel alloy steels.

Trac-Truk's Cummins Diesel and Waukesha gasoline engines depend upon Nickel to make iron castings stronger and more uniform in structure, more resistant to wear.

ALLOY NICKEL STEELS

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

She'll never be Stranded *in* Singapore!

. . . and here is the Reason Why!

EVEN the best of equipment sometimes needs servicing. But when that time comes—in Singapore, Southampton or Seattle, will competent service be available?

It certainly will be—if it's American Bosch Fuel Injection Equipment. Service facilities for American Bosch are nation-wide, world-wide. Be sure to specify American Bosch Fuel Injection Equipment. AMERICAN BOSCH Corporation, Springfield, Mass.

AMERICAN BOSCH

Fuel Injection STANDARD OF AMERICA WORLD WIDE SERVICE *Equipment*

CUTS 6 TO 7 GALLONS PER DAY FROM GASOLINE USED ON ONE DRAGLINE

• A reduction in gasoline consumption from 56 gallons per day to less than 50 gallons on his dragline alone prompted a central state contractor to write, "We want to take this opportunity to compliment the Standard Oil Company on their splendid Automotive Engineering Service.

"This reduction of 6 to 7 gallons per day will be a real saving in a year's time, which makes us feel that this word of appreciation is the least we can give."

To the Automotive Engineer this was all in the day's work. Taking each gasoline-powered unit in this fleet in turn he checked all known sources of power waste with scientific instruments. Weak coils and condensers were located. Poor connections and worn distributor points were replaced. Combustion was analyzed and corrected. When this thorough examination was completed, fleet costs *had* to drop.

Savings up to 20% in total operating costs have been made through this service, even in well kept fleets. Every contractor in the middle west can have this same service. It costs nothing. Engineers are located in 30 Standard Oil (Indiana) offices to answer your call. Just write 910 South Michigan Avenue, Chicago, Illinois and ask for the Engineer nearest your garage.

Burned distributor points are just one of the 17 factors that a Standard Automotive Engineer checks to secure the greatest economy in mileage and maintenance for you.

Copr. 1939, Standard Oil Co. (Ind.)

STANDARD OIL COMPANY (INDIANA

AUTOMOTIVE ENGINEERING SERVICE LOWERS MILEAGE COSTS

IN BUILDING LIFE INTO WICKWIRE ROPE

"BEYOND SPECIFICATIONS" . . . .

Samples of every piece of wire that goes to make up a Wickwire Rope are twisted and twisted. The number of complete turns each withstands is carefully recorded. No wire is acceptable unless its quality, as established by the twist test, meets Wickwire Spencer standards which are far in excess of recognized official specification standards. High ductility of rope wire means long fatigue rope life and service dollars in the pocket of the user.

WICKWIRE ROPE

It is still the privilege of the progressive manufacturer to build rope life into his product beyond official specifications.

WICKWIRE SPENCER STEEL COMPANY

General Offices: 41 East 42nd Street, New York City; Sales Offices and Warehouses: Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles, Tulsa, Chattanooga, Houston, Abilene, Texas, Portland, Seattle. Export Sales Department: New York City

THEY GET FIRST CRACK AT THE BIG JOBS!

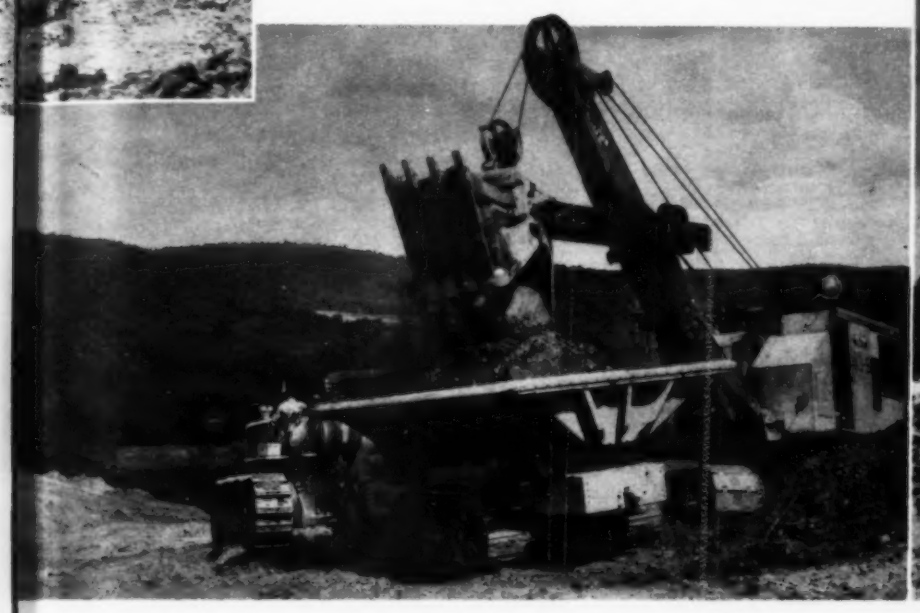
A Gardner-Denver compressor gets its power from a "Caterpillar" Diesel D13000 Engine at Tionesta Dam.

When Tionesta Dam is finished, it will be 1050 feet long and 150 feet high. This view of the spillway site shows two bulldozer-equipped "Caterpillar" Diesel D8 Tractors demonstrating the profitable way to handle loose, soft earth!

Tionesta Dam—a flood-control project in Pennsylvania. Grove-Lundin, Minneapolis, Minnesota, has the contract. Here are six of their eleven "Caterpillar" Diesel units on the opening of the job. This is the site of the spillway which will furnish about 800,000 yards of dirt and 250,000 yards of rock—out of the total of 2¼ million yards!

When there are 2¼ million yards to move, loads like this really count . . . really make money! But you need a "Caterpillar" Diesel Tractor (this one is a D8) to keep the dirt on the go!

Big jobs call for big loads—and here is one almost ready to go away! The Bucyrus-Erie shovel is powered by a "Caterpillar" Diesel Engine. The wagon is a 14-yard Athey. The tractor is a "Caterpillar" Diesel D8.



Construction men, nowadays, aren't putting any faith in the old saying: "a bad beginning makes a good ending." On big jobs, especially, they start right so they'll end right—take their first crack with "Caterpillar" Diesel Power!

Tionesta Dam, in Pennsylvania, got under way on that basis . . . and is proceeding toward a good ending. Faced with moving more than 2¼ million yards of earth and rock, Grove-Lundin—of Minneapolis, Minnesota—put "Caterpillar" Diesels to work!

Here is the kind of dependability that sees a job through from start to finish. For "Caterpillar" Diesels are built with punishing loads and punishing hours in mind . . . built for days of trouble-free operation . . . built to last more than long enough to earn you a profit on your original investment.

Yet there is something more to this equipment than the saving of time and money on repairs—and the writing-off of its first cost through a long, useful life.

Fuel-economy, alone, is reason enough to put "Caterpillar" Diesels to work. But on top of that, you get a particular ability—tremendous power and positive traction that make you independent of weather conditions—to earn a profit on the toughest job!

See your nearest "Caterpillar" dealer, and let him help you forecast the money-making possibilities in a "Caterpillar" Diesel-powered operation!

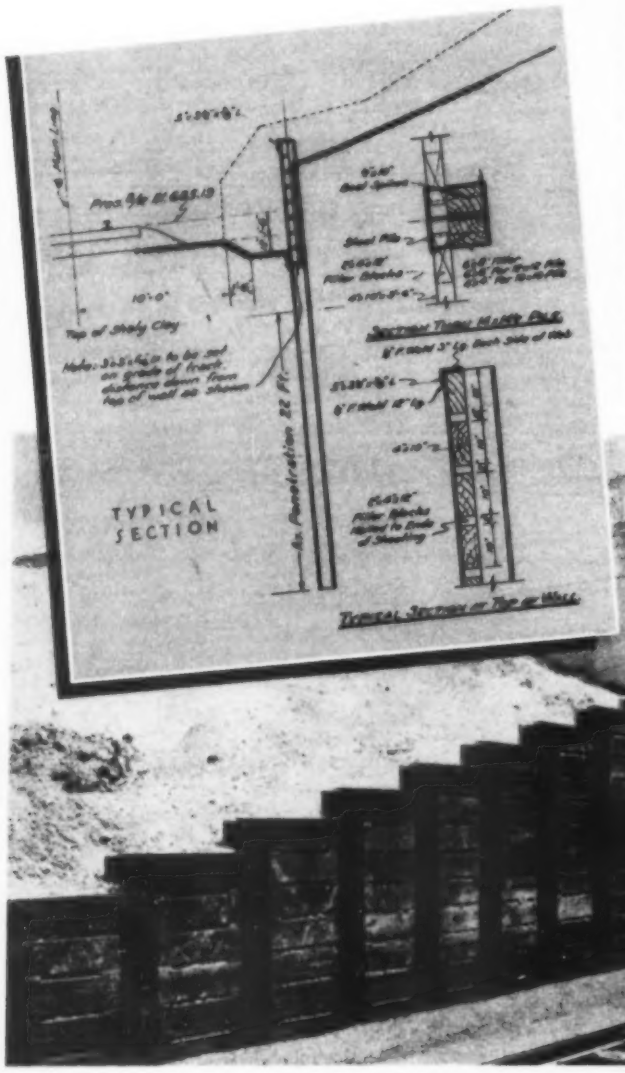
CATERPILLAR TRACTOR CO., PEORIA, ILL.

CATERPILLAR

DIESEL ENGINES

TRACK-TYPE TRACTORS • ROAD MACHINERY

A New Fast Way to Build a *Low-Cost* RETAINING WALL



Wing Wall adjacent to over-pass. Photograph below illustrates how easily U·S·S Bearing Pile construction is adapted to increased height of retained earth. The piles used here were spaced 4 ft. o.c. and vary from 14″ x 14½″ x 103 lb. per ft., 39 ft. long to 12″ x 12″ x 65 lb. per ft., 32 ft. long.

Clean-cut economical construction. In the 375 ft. of wall north of over-pass, U·S·S Bearing Piles 12″ x 12″ x 53 lb. per ft., 29 ft. long are spaced 5 ft. o.c. The creosoted sheeting, 4″ x 10″ is separated by 2″ x 4″ x 12″ separator blocks and backed up by creosoted filler blocks set vertically against pile web and flange as illustrated in the pile cross-section to the left. Complete length of retaining wall 797 ft. overall.

Here, construction with U·S·S Steel Bearing Piles provides efficient, economical, right-of-way protection!

SIMPLICITY is the keynote of this easily erected and versatile retaining wall construction. Designed and constructed under the supervision of G. L. Staley, Bridge Engineer, and under the direction of F. Ringer, Chief Engineer of the Missouri-Kansas-Texas Railroad. Illustrations show its application where the main line track runs adjacent to a sharp slope through the Big Cut in the city of San Antonio.

In addition to its comparatively low cost, it has the special advantage that it can be erected in quick time and with no interruption of traffic, for it does not require excavation on the track side of the wall for spread footing and also eliminates the considerable excavation behind the wall usual with ordinary construction.

The U·S·S Bearing Piles which form a steel backbone for the wall, acting as cantilevers, take the entire thrust of the slope. They are driven in lengths from 29 ft. to 39 ft. to an average penetration of 22 ft. into the shaly clay and stiff clay bottom. Piles are increased in length and weight, and are set on closer centers as the height of retained earth increases.

In this instance, creosoted wooden sheeting was used between the piles, but this construction is equally adaptable to the use of precast concrete slabs, poured concrete or steel plates.

U·S·S Steel Bearing Piles are the strongest, most permanent, most easily driven form of pile you can use. They are available from an unfailing source of supply that makes them immediately obtainable regardless of the size or location of the job.

U·S·S STEEL BEARING PILES

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

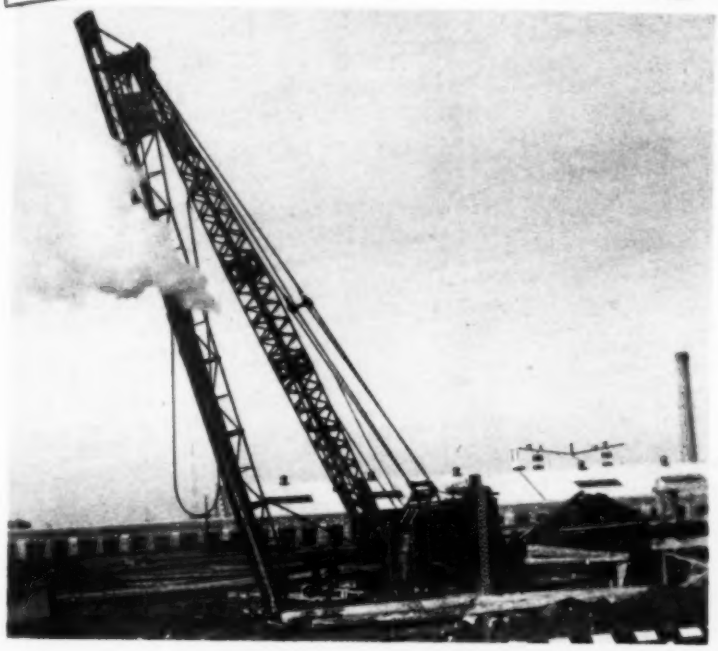
Speed-o-Matic

SHOVEL - DRAGLINE - CRANE

THE TOUGH JOBS *prove Speed-o-Matic's superiority!*

The tough jobs are the real test and Speed-o-Matic has what it takes to make good even on the toughest. The short-throw hydraulic control levers which eliminate the slow, back-breaking hand-levers give Speed-o-Matic a flexibility and speed that result in greater production per hour at definitely reduced costs.

Driving Straight and Batter Piles with leads up to 105 ft. long!



● By converting a Link-Belt K-480 Speed-o-Matic crane with a 75 ft. boom into a pile driver, Nicholas Pile Co. handled piles from 80 ft. to 105 ft. long and drove them to refusal. In the words of Bob Ferris of the Nicholas organization, "We got this job because I assured the general contractor that we could drive batter piles 1 to 3 or a tow of 1 ft. in every 3 of height—and we did. No other crane on the job could do this without winding up in the soup!" That's the kind of performance Speed-o-Matics are ready to deliver for you — write for full details today!

The exclusive hydraulic control principle with its easy, short-throw levers makes the operation of a Speed-o-Matic as effortless as driving a car. Operator fatigue is banished and higher efficiency is maintained throughout the working period.

LINK-BELT COMPANY

300 West Pershing Road, Chicago Distributors and Offices in Principal Cities 7625 A

LINK-BELT

MORE POWER TO

Le Tourneau said it in 1938 by selling more Carryalls than all other scrapers combined*

(Above) Dependable power in the pinches! When flood waters threatened grazing land near Adel, Oregon, M. C. Ranch worked its LeTourneau Angledozer 16 hours a day . . . built 180 feet of levee each 8-hour shift, with the high fast blade thrust, delivered at a flick of the cable control lever. (Below) Contractor Tom Klinpeter, Baton Rouge, Louisiana, found the powerful cable operation equally effective in the woods. His LeTourneau Bulldozer blade, set at a plow-like digging angle, first sheared roots alongside the larger trees. Then, the extremely high lift, plus forward tractor motion, knocked the trees over — saved hand cutting and stump pulling.

Legend has it that Sampson's strength was in his hair. When the locks were clipped, his super features were reduced to that of the rank-and-file.

It's no legend — but fact — that the "super" features of operation of all LeTourneau equipment depends, in a large measure, on the LeTourneau Power Control Unit. Let's forget for the moment the sheer brute strength that only heat-treated, alloy steel gears, pins and shafts throughout, plus all-welded steel cases, can give. It's evident — recognized by the thousands who have standardized on LeTourneau control.

But never can the double deck sheave arrangement be overlooked — not for one moment! Its function is far too important — savings in time and maintenance are too great! Regardless of the position of the equipment under working conditions, the fair lead sheaves are always self-aligned to the equipment — for straight, *natural* cable pull. Upper sheaves *spool* the cable evenly onto the drum in a way that supports the cable on THREE sides . . . prevents distortion by flattening or "piling". Grooves in the steel sheave wheels are *machined* to give the same three-way cable support and eliminate abrasive wear. Sheave wheels ALL AROUND are larger than average used . . . add to smooth, free-running cable. Every sheave wheel runs on oversize heavy duty roller bearings . . . cuts power demand. Talk with your cable man about this feature. He'll tell you LeTourneau has engineered the entire operation of the Power Control Unit and equipment sheaves to save you money and speed action.

Your "Caterpillar" and LeTourneau dealer will show you — on your own jobs the results. Won't you see him today? R. G. LeTOURNEAU, INC., Peoria, Illinois, Stockton, California, Cable address: "Bobletorno".

(Below) Extra pay yards up to the spring pipe! It remained for R. G. LeTourneau to build the right capacity Scrapers to take advantage of one tractor's towing ability and two tractors' horsepower for loading. As a result, based on an average 800-foot haul, pay loads per horsepower increase 50% and more. All the while, positive control is within the "catskinner's" grasp in all types of materials. Look for this feature first in a scraper. Only one with independently operated apron and tailgate will guarantee this performance. You'll appreciate it most when your work range calls for sand — then mud — then clay or loam. Positive ejection wipes every load clean . . . "polishes" the bowl for a faster next load. Here, one of Utah Construction Company's 20-Yard Carryalls is pusher loaded to extra profits; the job — relocating 32 miles of Union Pacific Railway, near Kingsley Dam, Keystone, Neb.

you!

HINGED SHEAVES FOR EVEN REEVING

(Left) Yavapai County's Rooter® speeds Carryall Scraper loading, increases each pay load, by breaking Arizona's sun-baked caliche. At the same time — at no extra tractor investment — the LeTourneau Angledozer, on the front, gets its powerful, instant action through a second cable from the same rear-mounted Double-Drum Power Unit. And don't forget: Rooters show savings on any type of hard digging — or even shatter old concrete for cheap Carryall removal. Your "Caterpillar" and LeTourneau dealer can show you how a Rooter increases scraper production at a rate that soon clears initial Rooter-'Dozer investment.

(Above) Fast, complete dumping of sticky clay, rubbery gumbo, stubborn rock, or just any material a scraper will load is assured by the Carryall positive ejection method. As with all cable controlled tools, complete operating success depends entirely on the LeTourneau Power Unit's double-deck fair lead sheaves, which allow the cable to go in a direct line to any point without rubbing on stationary parts — whether the Carryall is jack-knifed at a right angle over a bank or dumping on a turn. Sheaves are engineered to support the cable on three sides, eliminate flattening, lengthen cable life.

(Right) Another LeTourneau "exclusive" . . . successful tandem Carryall operation! Here, one "Caterpillar" D8 and one operator handle two LeTourneau Carryalls on highway relocation for Contractor Roy L. Bair, near Moscow, Idaho. Cable control, provided by the LeTourneau Four-Drum Power Unit is the only successful, job-proved method of operating scrapers in tandem. LeTourneau pioneered the idea . . . showed earth-movers tandem Carryall profits on hauls heretofore considered profitable only by truck and shovel methods. Compare the savings with single units of like capacity. Figure, too, the protected equipment investment when your jobs call only for small yardages and medium hauls.

1939! The Most Complete Line of

LETOURNEAU

MODERN *Earthmoving Equipment*

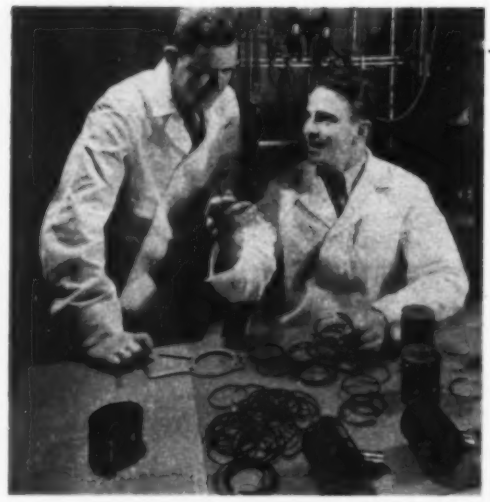
Angledozers®, Buggies®, Bulldozers, Carryall® Scrapers, Cranes, Drag Scrapers, Power Control Units, Rooters®,

Better Oils--
lower maintenance costs!

GULF RESEARCH TECHNICIANS develop improved lubricants . . . help contractors reduce operating costs!

PICTURED above is a typical scene in the Gulf research laboratories. Gulf technologists, in this instance, are working with an experimental Diesel engine, studying Diesel lubrication problems. Nearby, another exhaustive research goes forward on the lubrication of a modern type of textile spindle. In the next room a railroad car bearing is being run under precisely the speed and load conditions of actual service. And a host of other lubrication problems —many of them born of our rapidly advancing mechanical age—are being studied each day by Gulf's large staff of scientific men.

To what end is this extensive research work carried on? What is its objective? By perfecting better lubricants, and better methods of applying them, Gulf is doing its part to *help industry reduce operating costs*—save money on maintenance and power, improve production and make the machinery for which you paid real money last longer.



These Gulf technologists are examining pistons and rings removed from the experimental Diesel engine shown above, after an extended period of operation. They find that ring sticking cylinder wear, ring wear, gum formation and objectionable deposits have been minimized by the proper use of the right grades of Gulf's higher quality Diesel lubricants.

Your machinery, old or new, will be better prepared to give you the efficient production you need when you protect it with Gulf's higher quality oils and greases. Available to you, through more than 1100 warehouses in 28 states, is Gulf's complete line of 400 quality oils and greases . . . and the services of an experienced Gulf lubrication engineer. Ask him to recommend proper lubrication for your equipment. GULF OIL CORPORATION, GULF REFINING COMPANY, PITTSBURGH, PA.

GULF INDUSTRIAL LUBRICATION

"We recommend HEIL DIG-N-CARRY SCRAPERS" say SATISFIED USERS

JONES BROTHERS

Producers & Distributors of "BLACK EAGLE COALS"

The Heil Co.
3000 N. Montana St.
Milwaukee, Wisconsin

Gentlemen:

We have found that the Heil Dig-N-Carry Scraper is especially adapted to cutting exceptionally hard material. We had anticipated using a rooter in connection with our operations in loosening and uprooting some shell rock which is mixed up with our overburden. Since using this Scraper we found it is absolutely unnecessary to use rooter, as this Scraper has enough down pressure to load itself in any condition which we have encountered.

We also find that in blue shale which we were unable to cut with other scrapers we were able to take about a two-inch cut and load within a distance of seventy-five feet.

Another advantage we find is that Scraper takes no additional power from the tractor when coming up from the cut after loading position. Also we find that we can unload in a higher gear than we could with other scrapers and it does not take as much power to force the dirt out and return scraper to loading position. During our recent operations we started to handle some fire clay mack and mud and we were able to unload this material easily. keeping the floor and sides of scraper clean each time as the scraping action of the lip on the movable endgate scrapes this material off the bottom and sides of Scraper each trip.

We were pleased the other day when we found it was necessary to haul some material from our shovel that it was easy to load into our Heil Scraper and haul material out. On a three hundred foot haul, we hauled more material with this set-up than we had previously hauled with three dump trucks, eliminating three trucks, three truck drivers and one dump man.

Very truly yours,

JONES BROS. "BLACK EAGLE COALS"

Get complete facts NOW concerning efficient Heil Dig-N-Carry Scrapers — Address your inquiry to:

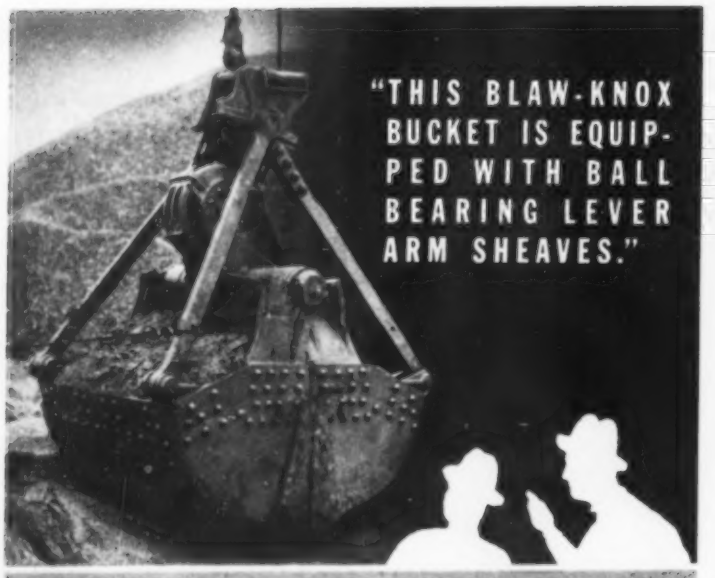
THE HEIL CO.

MILWAUKEE, WISCONSIN HILLSIDE, NEW JERSEY

Above: One of three 12 yd. Heil Dig-N-Carry Hydraulic Scrapers in the service of Wm. Lathers, Jr., Madison, Wisconsin. **Below:** Note short turning radius.

Below: Heil Dig-N-Carry scraper backsloping on a 2 to 1 grade. Heil scrapers have low center of gravity to insure stability on any grade that tractor can operate on.

Below: Quick-opening, floating front-gate opens wide to permit fast unloading. "Even wet, sticky clay can be unloaded and spread without any undue delay or trouble."

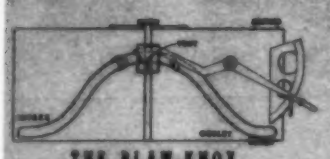


As a matter of fact this feature is standard equipment and does not cost more. It is especially desirable where the bucket handles loose granular materials because it keeps lubrication in and dirt out. This and many other desirable features of Blaw-Knox Buckets is fully described and illustrated in Bulletin No. 1606. Write for it today.

17

BLAW-KNOX BLAW KNOX DIVISION OF BLAW-KNOX CO. Farmers Bank Bldg. Pittsburgh, Pa.

Digging and Rehandling **BUCKETS**



THE BLAW-KNOX WATER MEASURING SYSTEM

Tests show—only Blaw-Knox TRUKMIXERS have this accurate, practical, dependable water measuring system. Described in Bulletin No. 1643.

Buy Blaw-Knox Trukmixers. Get the advantage of automatic accurate water measurement, together with many other exclusive features.

20

BLAW-KNOX BLAW-KNOX DIVISION OF BLAW-KNOX CO. Farmers Bank Bldg. Pittsburgh, Pa.

TRUKMIXERS *and Agitators*

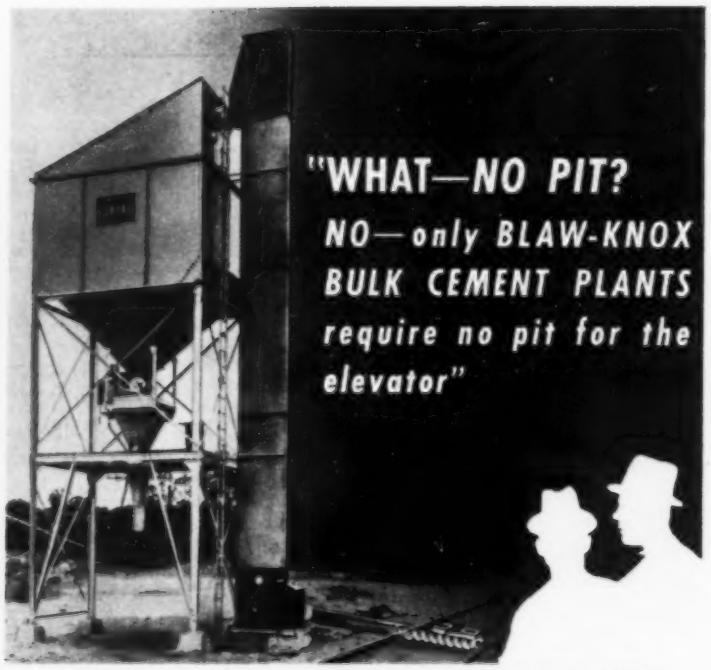
For compacting earth fills—the practical design of Blaw-Knox Sheepsfoot TAMPING ROLLERS appeals to contractors because they give uninterrupted service and meet all modern specification requirements.

The roller units are full floating, on husky frames—built for long, hard use.

Send for complete details and prices.

BLAW-KNOX DIVISION of Blaw-Knox Co.
FARMERS BANK BLDG. PITTSBURGH, PA. 19

BLAW-KNOX TAMPING ROLLERS



Blaw-Knox BULK CEMENT PLANTS are the ultimate in portability, speed, and convenience of use and operation. They are *complete units* for unloading, storage, batching and handling of bulk cement—dependable and accurate.

21 Completely described in Blaw-Knox Catalog No. 1566. Send for copy.

BLAW-KNOX BLAW-KNOX DIVISION OF BLAW-KNOX CO. Farmers Bank Bldg. Pittsburgh, Pa.

Bulk Cement Plants

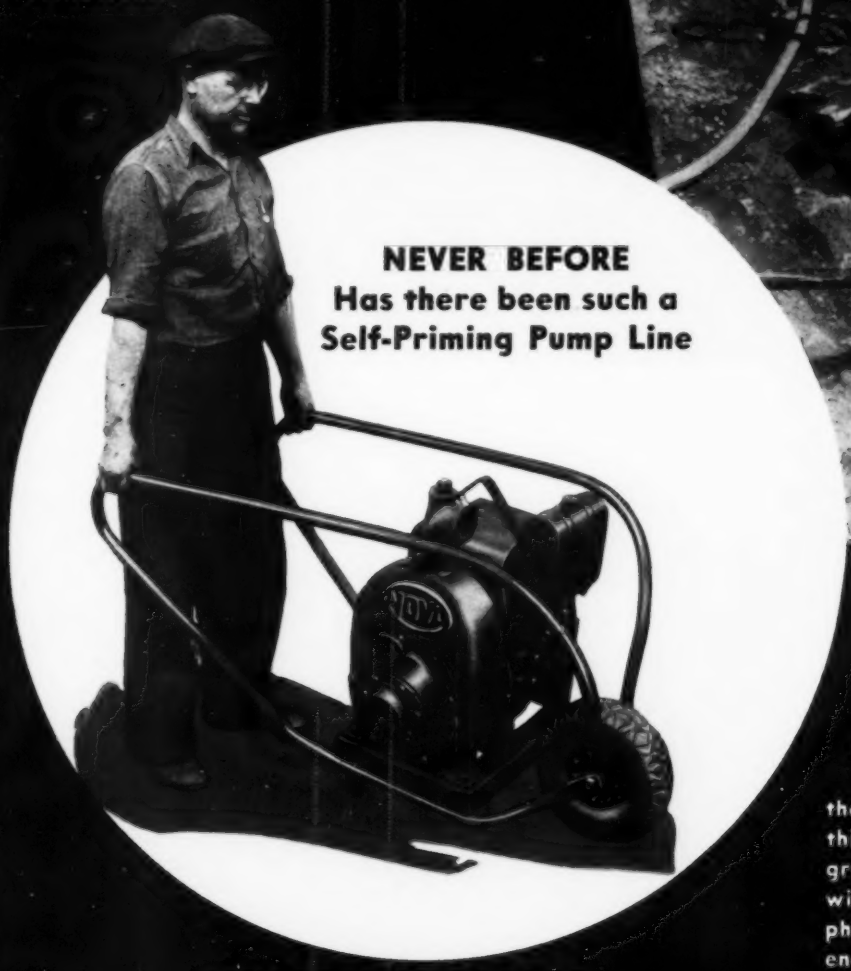
GET INTO THE PROFIT CLASS

WITH NOVO PUMPS

Whether it's on the *Highways of Tomorrow* or the *Construction of Today*, the new features incorporated in the Novo Pumps mean profits to you. They just can't miss and you can prove it to yourself.

See them at The Road Show in San Francisco, Booth B-41. Come in!

(Also send the coupon for full information.)



NEVER BEFORE
Has there been such a Self-Priming Pump Line

WHAT, NO SEALS?

No, Sir! There are no air seals on the impeller shaft of the new Novo Model K Self-Priming Centrifugal Pumps, so there goes your biggest source of trouble. Send for the literature and see why. They can't fail if your suction line is tight.

They have big, sustained volume—longest possible service. Simple and easy adjustment for wear. They can't be beat.

And there is a size for every job. — 3M — 7M — 10M — 15M — 20M — 30M — 40M — 75M — 90M — 125M — (A. G. C. ratings refer to 1000 GPH.)

Drop that coupon in the mail and see for yourself.

NOVO ENGINE CO.

214 Porter St. Lansing, Mich.

THE NEW DIAPHRAGM PUMP

Did you ever see anything neater than that new Novo Lift and Force Diaphragm Pump above? That isn't half of the news about this easy-to-handle, big-capacity, utility pump.

You know the old, never-fail operation of the diaphragm pump on tough pumping jobs—thick muddy water, heavily laden with sand, gravel, and debris—large quantities of air with intermittent pumping. The new Novo Diaphragm eats these jobs up—besides, it has the enclosed gearing and close-coupled modern design.

Get the dope below.

Send this Coupon

NOVO ENGINE COMPANY, Lansing, Mich.
Please send full information on the

New Novo Diaphragm Pumps.....

New Novo Self-Priming Pumps.....

Name.....

Address.....

City..... State.....

ANNOUNCING

CLETRAC MODEL F DIESEL
95 drawbar horsepower; 107.5 belt horsepower; also available with gasoline engine—94 drawbar horsepower; 110.93 belt horsepower

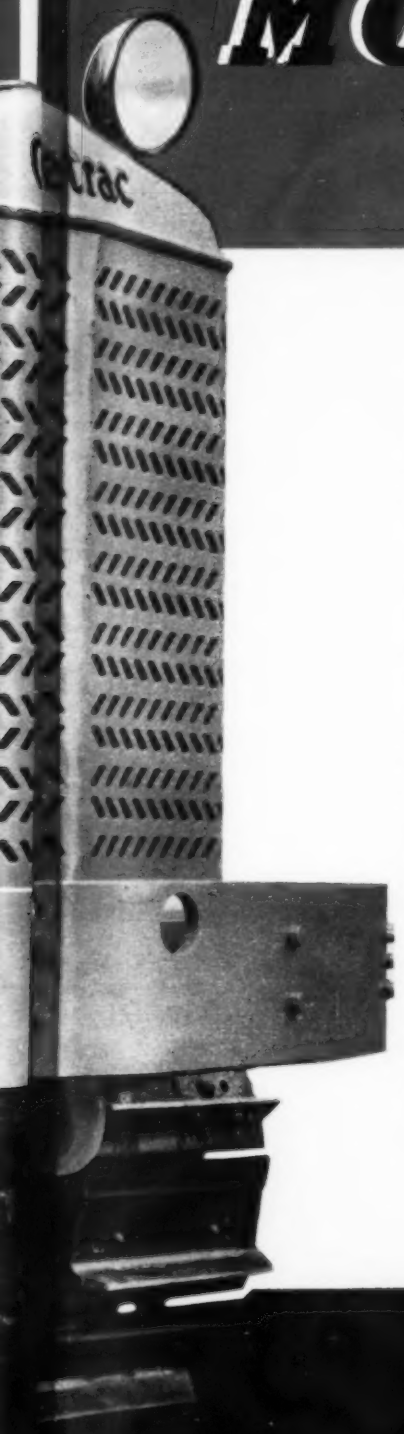
CLETRAC MODEL F PERFORMS JOBS LIKE THIS . . .

● Operating a 20-yard scraper at Marten, Neb. Contractor—Morrison Knudsen Co., Inc.

● Bulldozing at Reedsburg, Wisconsin. Contractor—Wm. Luthers, Jr.

● As operated by the U. S. Bureau of Roads Beltsville, Md.

A NEW AND FINER
MODEL F CLETRAC
OF MORE THAN 95 HORSEPOWER



TWO YEARS and three months ago, Cletrac engineers began developing a bigger and better Model F Cletrac. Cletrac Model F had always done a good job—but users asked for more power . . . more speed . . . heavier, sturdier construction—streamlined design . . . a dozen new things in a tractor that would meet the ever-increasing demands of industry for heavy-duty work.

The new Cletrac Model F is an answer to these demands. Here is a tractor that has the capacity to handle the largest scrapers and wagons on construction jobs . . . maximum footage in lumbering . . . the heaviest trailbuilders, bulldozers and graders on road building work.

With four forward speeds, two reverse, and a high of five miles per hour, this new Model F reduces time on every trip . . . gives greater performance each day with larger production and lower costs.

PROVED IN MANY MONTHS OF SERVICE

In announcing this new Cletrac Model F, we are able to bring you outstanding performance records because this tractor has been on the job and *proved in service for many months.* This is the first time a new, powerful tractor has been announced only after use and acceptance by many of the largest contractors in the country. These "on the job" tests have proved Cletrac Model F:

- ★ **Sturdier—it's built for tough conditions**
- ★ **Heavier—it provides more powerful traction**
- ★ **Faster—it handles more loads per day**
- ★ **More Powerful—it tackles bigger jobs**

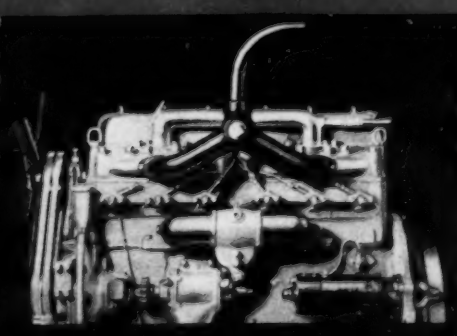
Go over this Cletrac F with a fine tooth comb. Compare it feature by feature. Ask your Cletrac distributor to demonstrate it on your own jobs. You'll prove to yourself that Cletrac Model F will give you the performance, the capacity, the dependability that means lower costs, more profitable operations.

Cletrac
Crawler Tractors
Built To Endure

THE CLEVELAND TRACTOR CO., CLEVELAND, OHIO

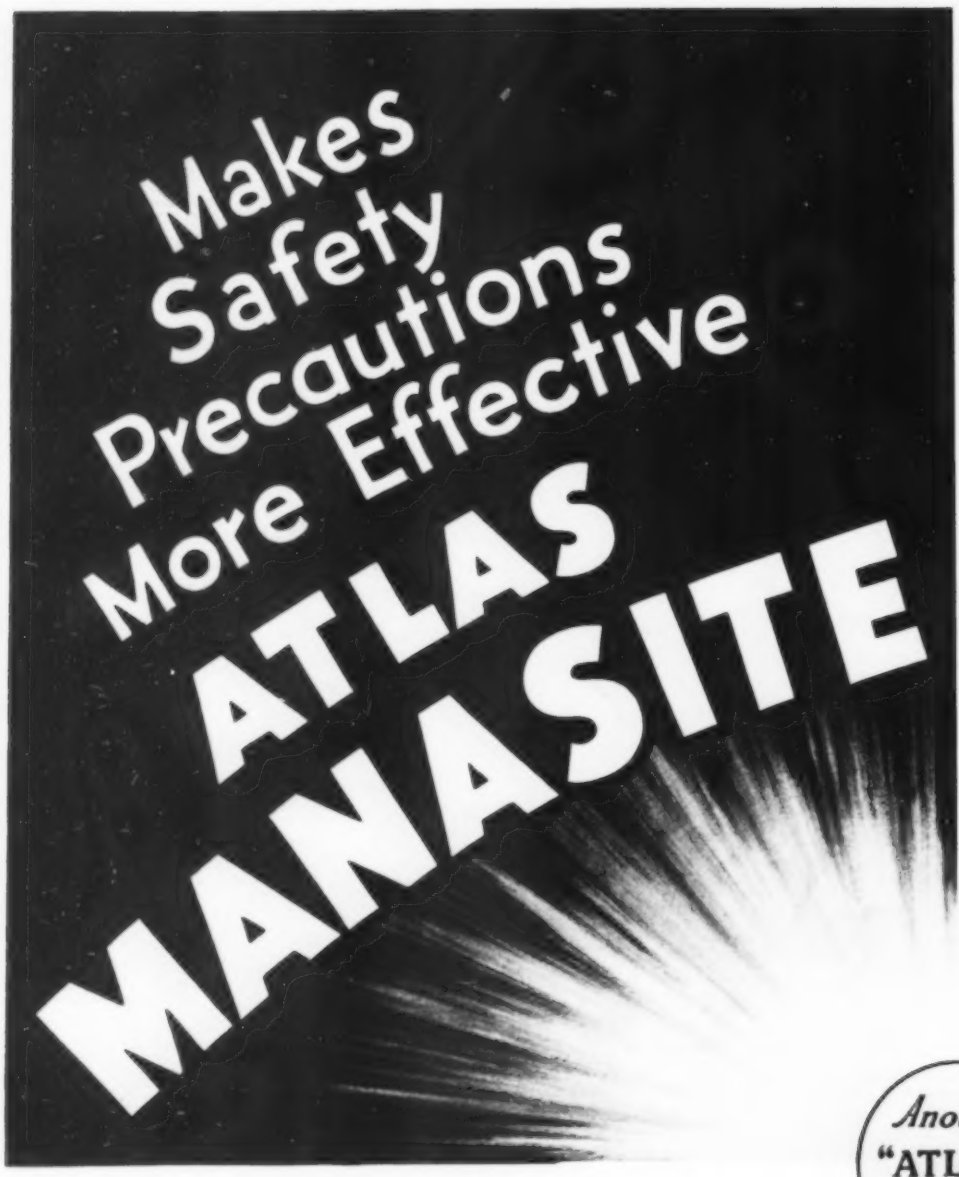
CLETRAC MODEL F HAS THESE AND OTHER FEATURES

● *Electric Starting* on both Diesel and gasoline models.



● *Modern Power Plant*—Six Cylinder Engine.

● *Controlled Differential Steering*—Cletracs pull on both tracks when turning.



If your memory of the explosives industry carries back a quarter century or more, you know that Atlas has always been a leader in safety developments. Not only has Atlas constantly urged careful observance of safety precautions, but Atlas Research has contributed more than its share in scientific progress toward greater safety in blasting.

Such a contribution is the Atlas Manasite Detonator—an improvement made possible by an exclusive method of using hexanitromannite. Atlas Manasite Detonators offer materially reduced sensitivity to impact and friction—with no loss whatever in efficiency. They bring a substantial increase in the margin of safety by lessening the possibility of accident through inadvertent mishandling.

Ask your Atlas representative for details.

Another "ATLAS FIRST"

ATLAS MANASITE

Blasting Caps
Accordion Fold Electric Blasting Caps
All-Metal Delay Electric Blasting Caps

ATLAS POWDER COMPANY, WILMINGTON, DEL.

Cable Address—Atpowco

Everything for Blasting

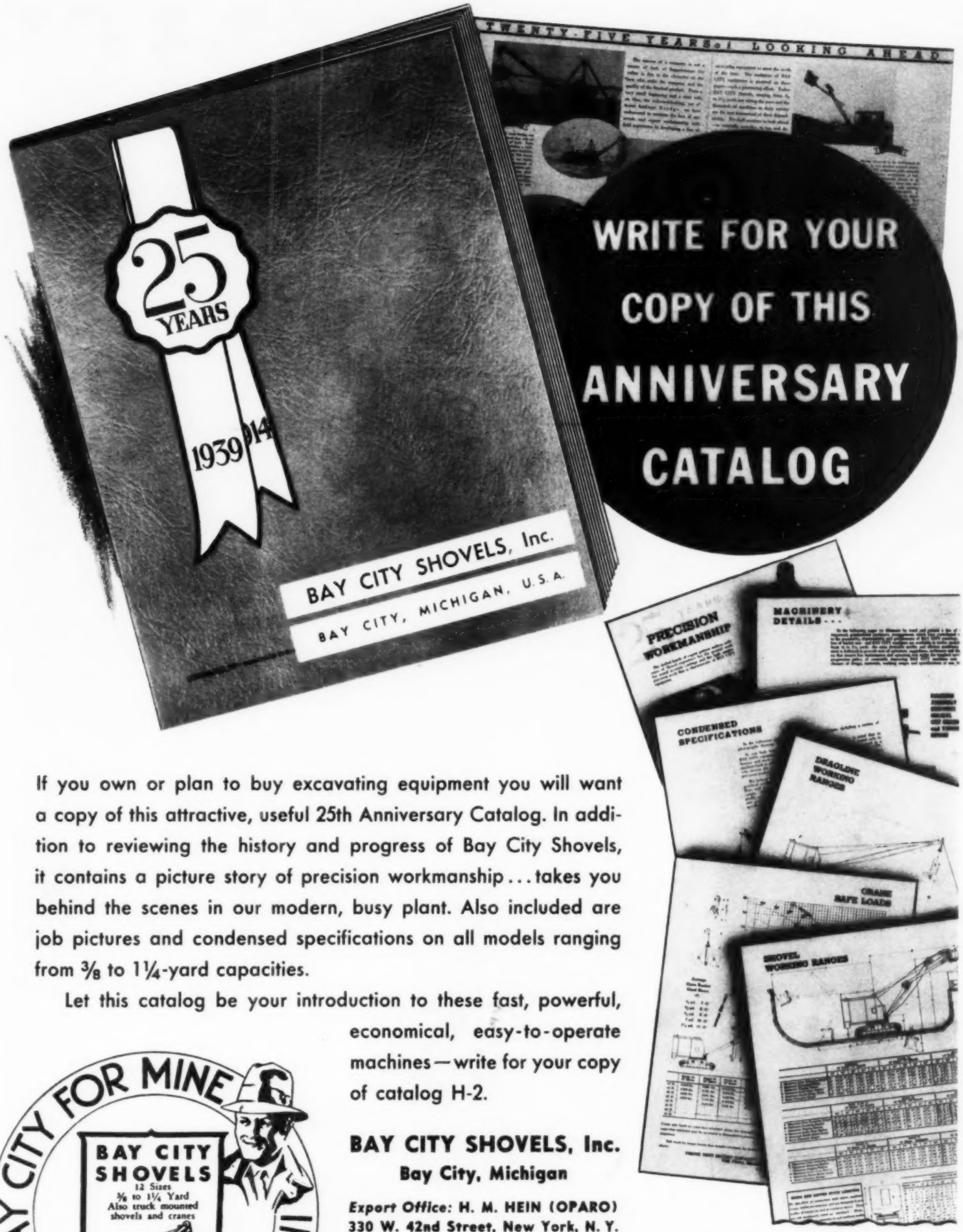
OFFICES

Allentown, Pa.	Houghton, Mich.	Memphis, Tenn.	Pittsburg, Kansas	Seattle, Wash.
Boston, Mass.	Joplin, Mo.	New Orleans, La.	Pittsburgh, Pa.	Spokane, Wash.
Butte, Mont.	Kansas City, Mo.	New York, N. Y.	Portland, Oregon	St. Louis, Mo.
Chicago, Ill.	Knoxville, Tenn.	Philadelphia, Pa.	Salt Lake City, Utah	Tamaqua, Pa.
Denver, Colo.	Los Angeles, Calif.	Picher, Okla.	San Francisco, Calif.	Wilkes-Barre, Pa.

ATLAS

EXPLOSIVES

CHEMICALS ATLAS EXPLOSIVES



If you own or plan to buy excavating equipment you will want a copy of this attractive, useful 25th Anniversary Catalog. In addition to reviewing the history and progress of Bay City Shovels, it contains a picture story of precision workmanship . . . takes you behind the scenes in our modern, busy plant. Also included are job pictures and condensed specifications on all models ranging from 3/8 to 1¼-yard capacities.

Let this catalog be your introduction to these fast, powerful, economical, easy-to-operate machines—write for your copy of catalog H-2.

BAY CITY SHOVELS, Inc.
Bay City, Michigan

Export Office: **H. M. HEIN (OPARO)**
330 W. 42nd Street, New York, N. Y.

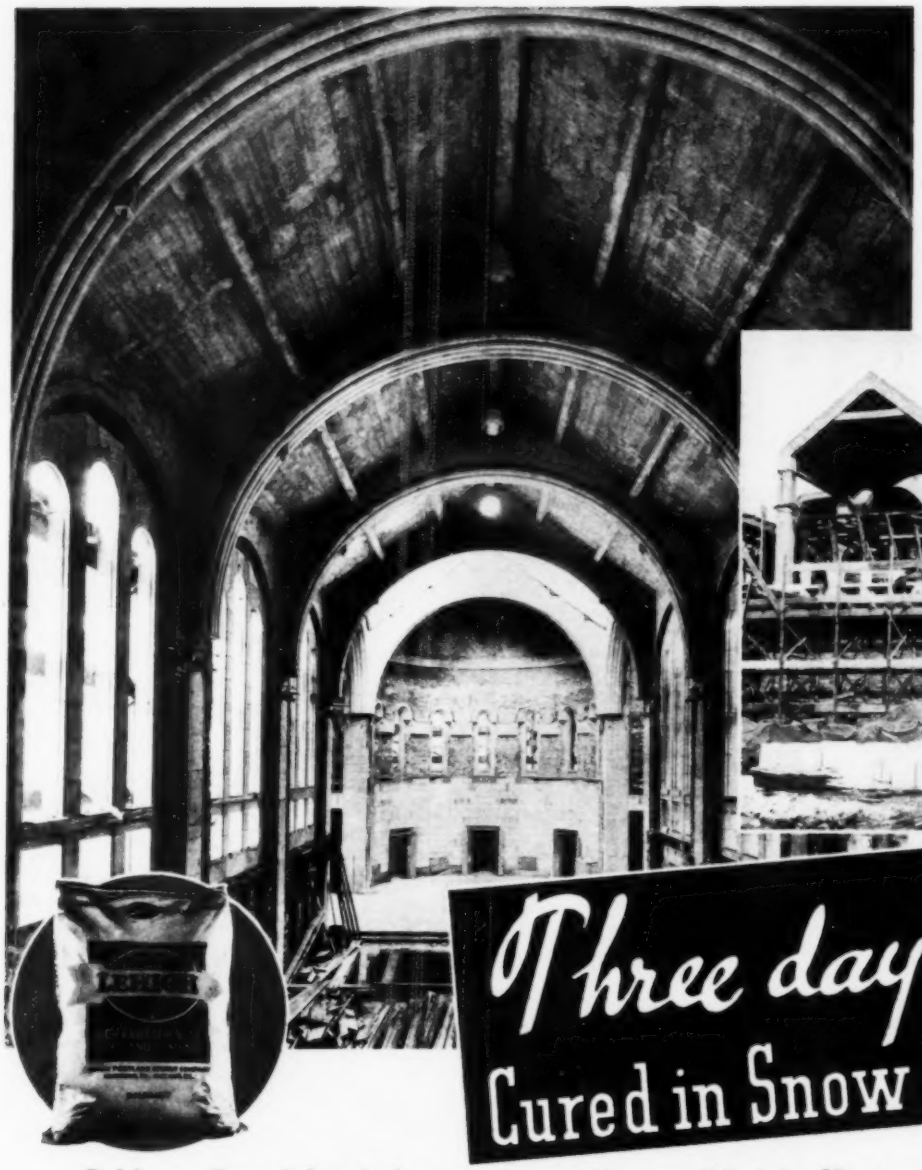
BAY CITY SHOVELS

KOEHRING

Move rock with Koehring equipment for low cost operation. Rock digging requires rugged equipment, as well as high speed, to maintain a maximum profit schedule. Many leading contractors now accept Koehring Shovels and Dumptors as dependable profit insurance in the toughest of rock digging and hauling. Dig it and haul it with Koehring.

KOEHRING COMPANY

CONSTRUCTION EQUIPMENT • MILWAUKEE, WISCONSIN



Mary Immaculate Seminary, near Treichlers, Pa.

General Contractor:
D. W. O'Dea Construction Co., Philadelphia

Concrete Contractor:
Senn-Herrick Corporation, New York

Architect:
Henry D. Dagit & Sons, Philadelphia

Three day old concrete Cured in Snow and Cold Weather

Cold weather did not slow up concreting on this job. Heat protection costs for concrete in place were eliminated altogether. Strength in less than 7 days was equal to 28 day strength required with normal cement. Forms were removed and reused in 3 days, cutting form costs for arches in half—only 5 sets were used instead of 10 which would have been needed with normal cement.

But these advantages are insignificant compared to the time saved. Quick completion of all concrete on chapel, including the roof, allowed continuous construction—snow and changeable weather were no handicaps. Quick service concrete expedited the entire operation.

Quick service strength, essential in winter, is of advantage at any season. Used under the same conditions, in 24 to 48 hours, the strength of Lehigh Early Strength Cement compares with that of normal cement at 7 days. Use it for key portions of the job for coordinating construction schedules—use it when quick completion will result in money saving. Use it for better, denser concrete.

LEHIGH PORTLAND CEMENT COMPANY

Allentown, Pa. Chicago, Ill. Spokane, Wash.

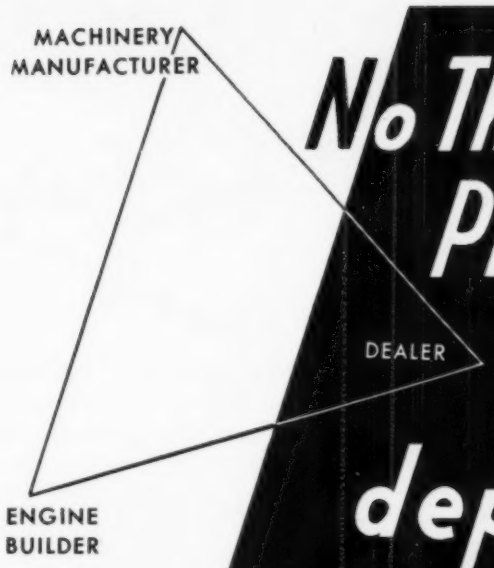
LEHIGH EARLY STRENGTH CEMENT

FOR ROADBUILDING and maintenance work, the peppy, hustling 10-B is the first choice of practical engineers, contractors and highway officials. Fast on-the-job moves are made with traveling speeds to 4¼ m.p.h. Fast job-to-job transportation is always available with a platform-type truck or with the special 10-B Trailer. The compactness and short clearance of the 10-B avoids traffic tie-ups and permits normal, high speed operation in narrow lanes and in tight spots. For more miles of road, and more economy in road work, investigate this world's fastest selling ⅜-yard excavator.

BUCYRUS ERIE

BUCYRUS - ERIE

SOUTH MILWAUKEE, WISCONSIN, U. S. A.



No Three-Cornered Service Problem when you buy CUMMINS dependable Diesel

Whether you buy new equipment powered with Cummins Diesels or re-power your old, you are assured the backing of a national service organization.

The responsibility for servicing your Cummins Diesel is in the hands of a crew of factory-trained service men and your local Cummins representative—no matter from whom you may have bought your equipment.

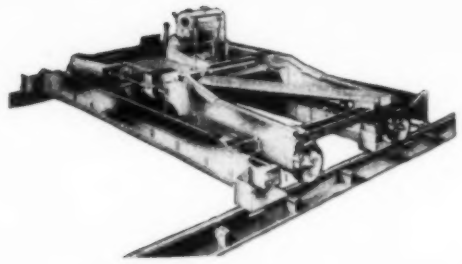
This means no divided responsibility—no question whom to call—should accident or emergency demand instant attention. Cummins Engine Company, 1716 Wilson Street, Columbus, Indiana.

Lima (Type 1001)—equipped with a 70' boom and a 5-8/10 yd. bucket, powered with 225 hp. Cummins Dependable Diesel, owned by the Morrison-Knudsen Company, Inc., working on the Tri-County Project of the Central Nebraska Public Power and Irrigation District.

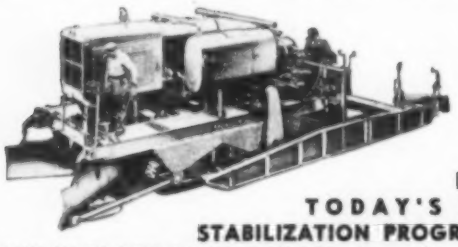
JAEGER OFFERS YOU

eger is the Successful Vibratory Finisher

—BETTER MACHINES and METHODS for 1939



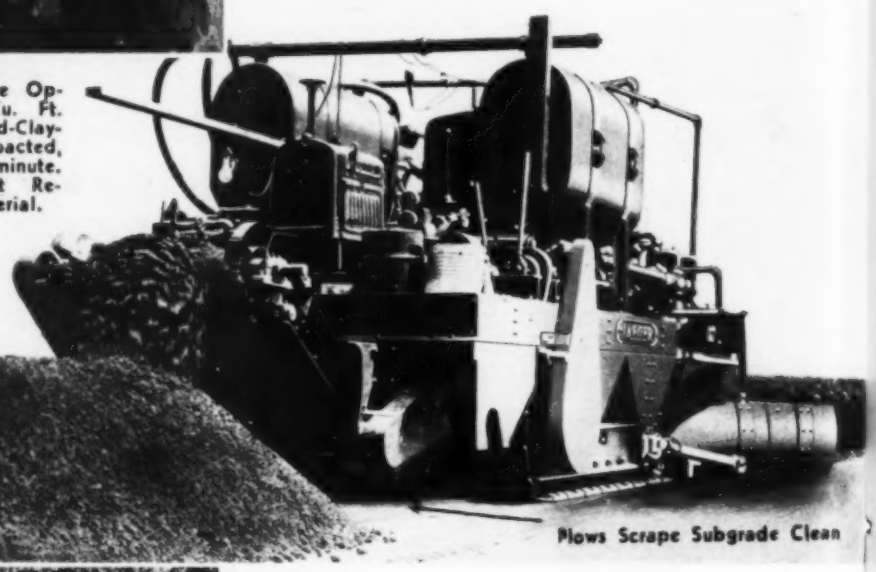
THE HIGH PRODUCTION TYPE "D" FINISHER, with capacity exceeding dual-drum or tandem paver outfits, with "velvet touch" smoothness, automatic power lift and the flexibility of steam obtained with inexpensive gas power, has become the preferred finisher in numerous states. Ask also about new low cost Widening Finisher—a real money-maker!



FOR TODAY'S BIG STABILIZATION PROGRAMS

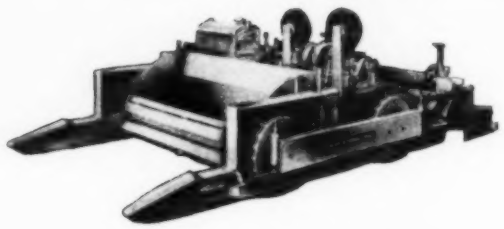
THIS MIX-IN-PLACE ROAD BUILDER thoroughly mixes up to 16 cu. ft. windrows at rate of 160 to 180 tons an hour. Many hundreds of miles of new base, top and retread work, from Minnesota to Mexico, prove huge economies and highest quality of mix. Popular priced tractor drawn models for light retreads.

One Machine and One Operator Mixing 12-14 Cu. Ft. Windrow for 36 Ft. Sand-Clay-Gravel Base, 3" Compacted, at Rate of 5' 3" per minute. Note Belt Attachment Re-Windrowing Mixed Material.

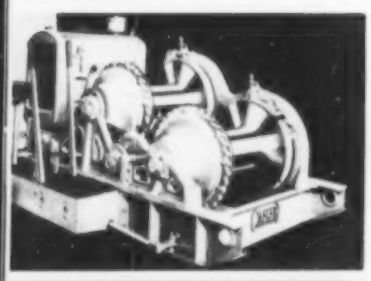


Plows Scrape Subgrade Clean

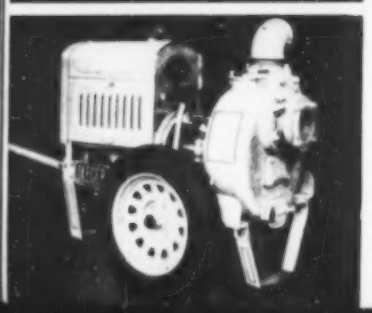
Jaeger Bituminous Paver Lays Stone and All Types Hot or Cold Bituminous, up to 14 Ft. Widths.



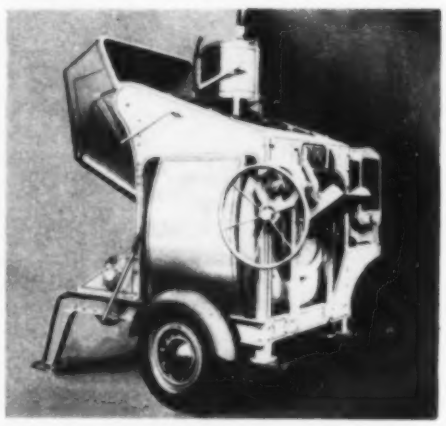
THE PAVER THAT LAYS A SMOOTHER SURFACE TOUCHED ONLY BY THE SCREED! No rollers mar or prematurely seal the perfect surface smoothed by the 17 ft. straight edge levelers of the Jaeger Bituminous Paver. All traction on hard subgrade, giving power, speed and capacity greater than most mixing plants. Adapted for quick width changes and laying flush to curb. Heated Screeds an exclusive Jaeger attachment.



JAEGER'S REVOLUTIONARY IMPROVEMENTS IN HOISTS include giant expanding frictions controlling loads up to 100 H.P. with 4 to 10 lbs. finger pressure, balanced drums on anti-friction bearings, many other advances.



WORLD'S LARGEST SELLING LINE OF CONTRACTORS PUMPS: Sure Prime Centrifugals 1½" to 10" sizes, for every purpose; Jetting-Dewatering Pumps, Caisson Pumps, Diaphragms, Triplex Road Pumps.



1939 TYPE SPEEDLINE END DISCHARGE TRAILER MIXERS—7S to 14S SIZES. Sensational in design, performance, price—faster, hundreds of pounds lighter, yet all vital parts ruggedly constructed, including machined steel drum tracks. Also Tilters, other Non-Tilts, 3½S to 56S sizes.

Plan your 1939 jobs with 1939 machines and methods—for high daily production, cost-saving, profit-making. Latest Jaeger catalogs supply important data. Write for copies and prices.

THE JAEGER MACHINE COMPANY

800 Dublin Avenue - - Columbus, Ohio

World's Leading Manufacturer — Concrete Mixers, Truck Mixers, Pumps, Hoists, Road Spreading and Finishing Machines.

Construction Methods and Equipment

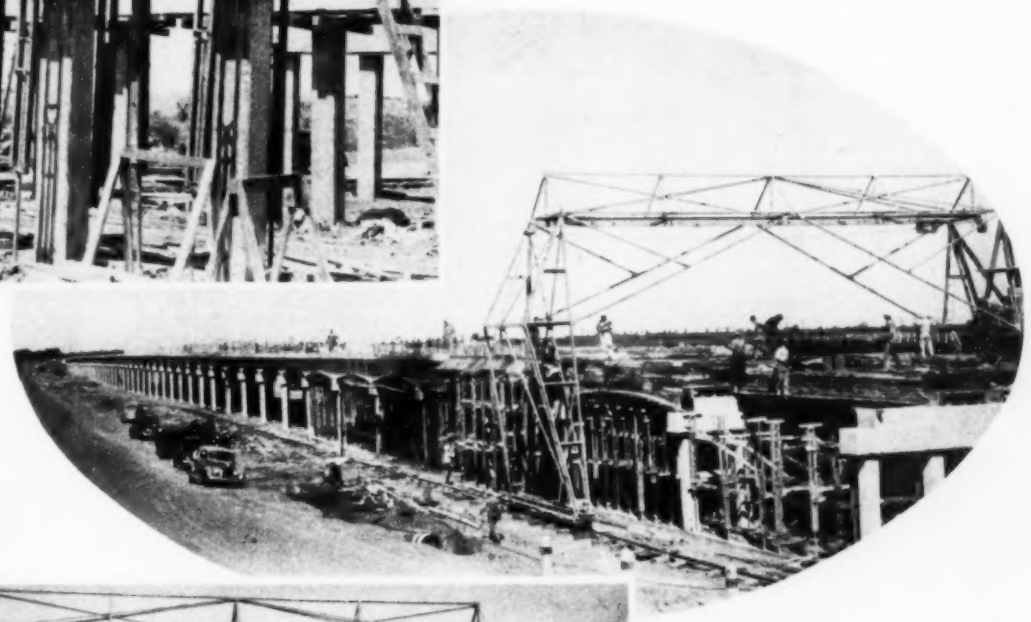
Established in 1919
A McGRAW-HILL PUBLICATION

ROBERT K. TOMLIN, Editor

Volume 21 — **February, 1939** — Number 2

ADJUSTABLE BUILDING SHORES (left) support cap and girder forms, simplifying falsework construction to permit rapid erection by crews composed mainly of unskilled labor. Forms for all exposed surfaces are lined with plywood.

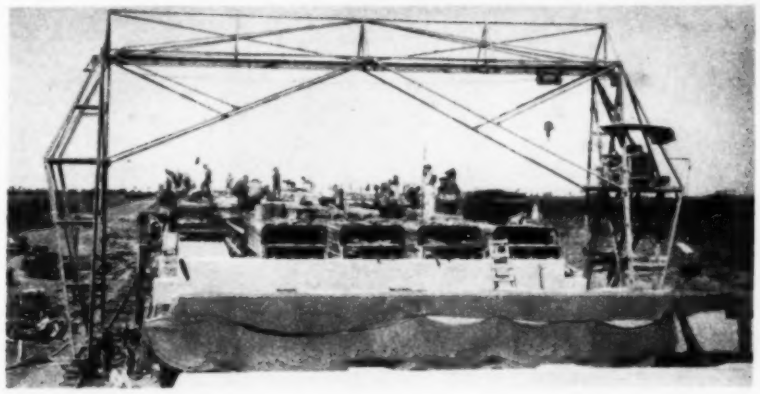
ROLLING GANTRY CRANE (below) straddling floodway bridge hoists and transports materials during construction of 52 30-ft. concrete spans.



Traveling Gantry Crane

Facilitates Construction of Long Floodway Bridge

By D. V. PURINGTON,
Bridge Division, State Highway Department, Austin, Tex.



OVERHEAD TROLLEY HOIST on traveling gantry handles forms, reinforcing steel and concrete for long bridge.

DURING CONSTRUCTION of the Mercedes Floodway bridge at Mercedes, Tex., the R. W. Briggs & Briggs-Darby Co., contractor, Pharr, Tex., made effective use of mechanical equipment. The bridge is a concrete pile trestle consisting of 52 30-ft. concrete deck girder spans with a 27-ft. roadway and two 5-ft. sidewalks.

In dismantling an existing timber trestle prior to construction of the new bridge, the contractor used a tractor-bulldozer to remove an asphalt wearing surface from the timber deck. On the new construction, a mobile steel gantry crane, running on steel rails laid on the ground at both sides of the bridge, facilitated handling of forms, reinforcing steel and other materials.

Concrete was mixed at a central plant by a 27E paver and was delivered in trucks to the gantry crane. The crane hoisted and spread the material with a minimum of hand labor, which was further reduced by use of mechanical vibrators for compacting freshly placed concrete in the forms.

The bridge division of the Texas Highway Department designed the bridge, which was constructed under the direction of J. W. Puckett, division engineer and George Houston, resident engineer. Julian Montgomery is state highway engineer, and Herbert Eldridge is acting bridge engineer. For the R. W. Briggs & Briggs-Darby Co., G. C. McBride was superintendent.

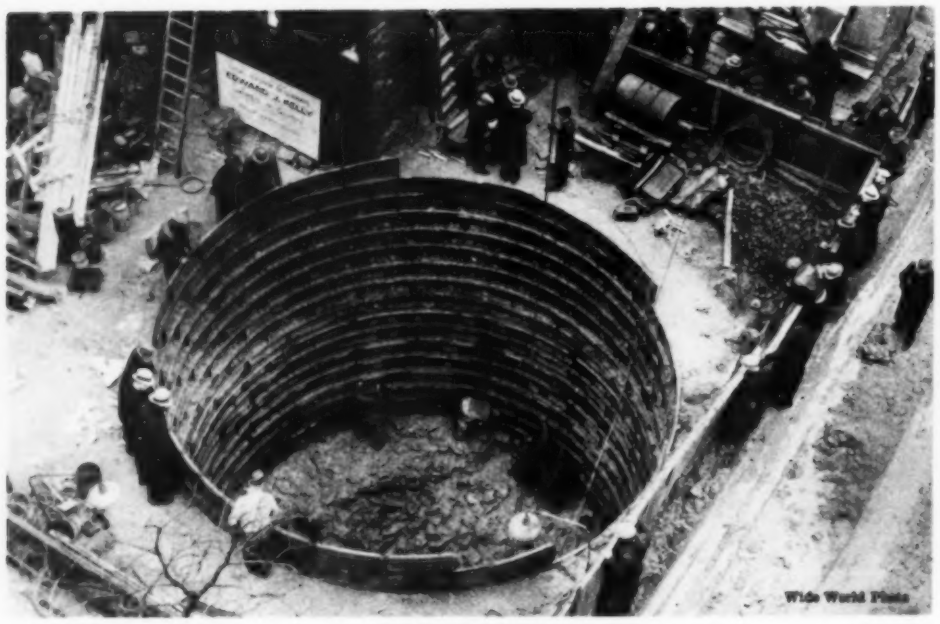
This Month's
"NEWS REEL"

Photo, Eric J. Baker

FIRST FLOOR STEEL (left) is erected by American Bridge Co. on Port of New York Authority's $18,000,000 Bronx-Whitestone bridge crossing East River with 2,300-ft. main cable suspension span, fourth longest in world, and 735-ft. side spans. Work, started in June, 1937, is being rushed to complete structure in time to handle traffic for New York World's Fair, 1939.

CHICAGO'S SUBWAY (below) gets under way as 26-ft.-diameter auxiliary shaft is sunk with aid of pressed steel liner plates to depth of 45 ft. at Chicago Ave. and Lake St. From shaft bottom drift tunnel will be extended to State St. where driving of actual subway bore 7½ mi. long will begin. Contract for first section was awarded to Herlihy-Midcontinent Construction Co., of Chicago, for $2,746,104. Resident engineer for $40,000,000 PWA project is Joshua D'Esposito.

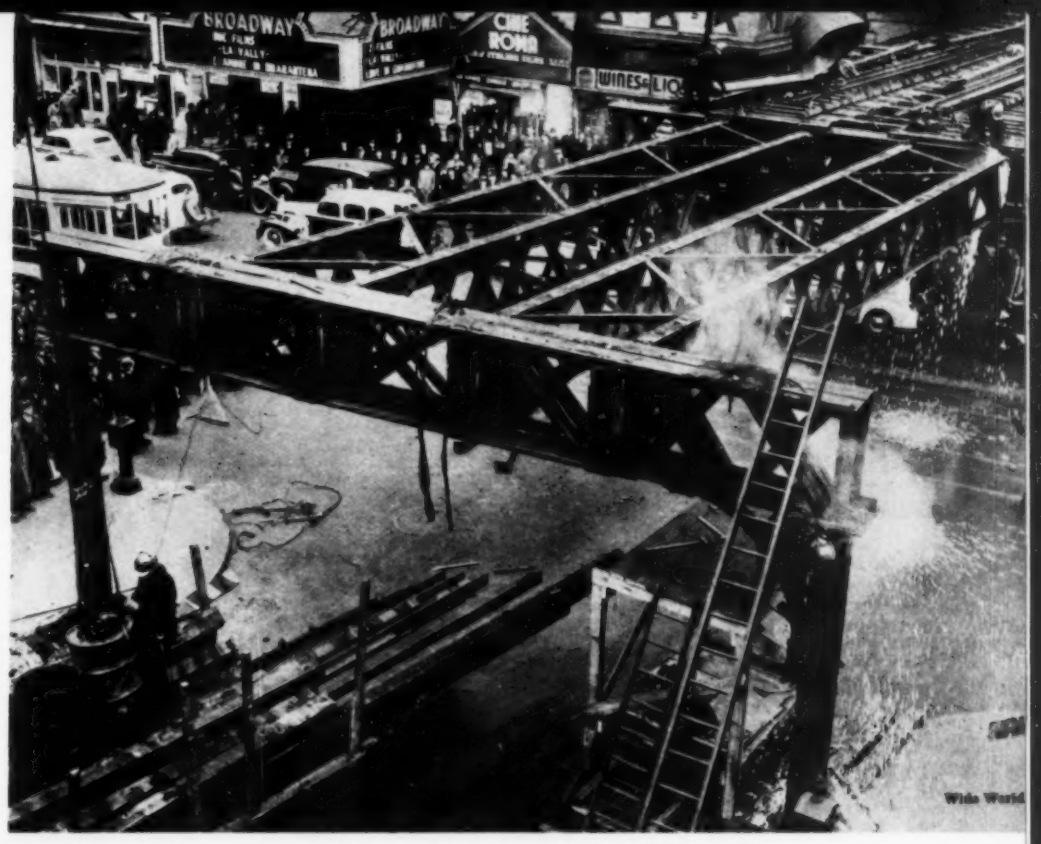
Acme Photo



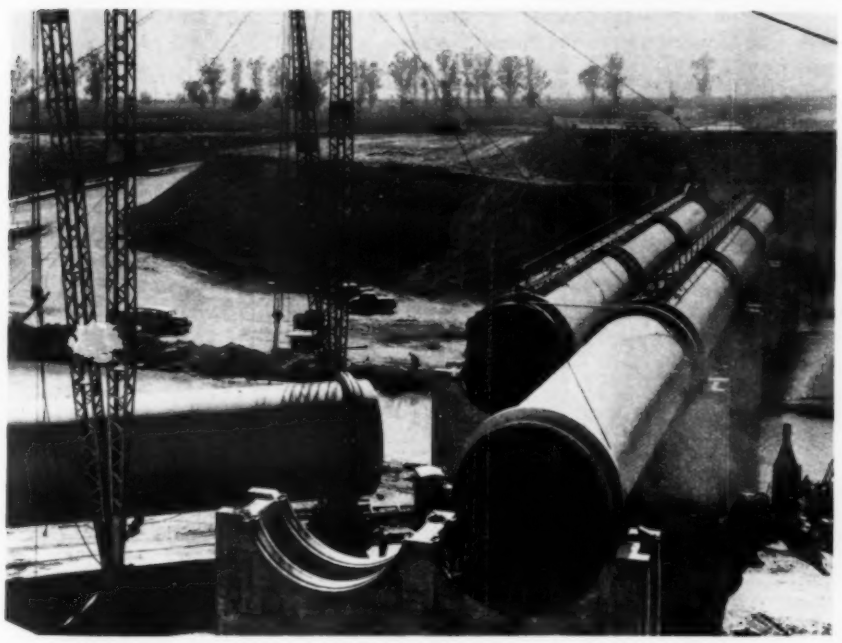
Wide World Photo

FIRST WATER FLOW into 392-mi.-long Colorado River aqueduct system in California occurs Jan. 7, as F. E. Weymouth (left) general manager and chief engineer of Metropolitan Water District of Southern California receives congratulations from W. P. Whitsett, chairman of the board, on culmination of 15 years of intensive engineering and construction work. Photo shows water, raised from Colorado River behind Parker dam by intake pumping plant, emerging from west portal of concrete-lined tunnel.

HEAVIEST GRADING PROJECT (below) ever awarded by California Division of Highways involves 2,198,000 cu.yd. in 6.3 mi. between Los Gatos and Inspiration Point in Santa Cruz mountains, where Heafey-Moore Co. and Frederickson & Watson Construction Co., contractors, operate scraper fleets, as illustrated at right and also on front cover of this issue. New Tournapull unit is powered by special 160-hp. diesel tractor mounted on two 80-in.-diameter pneumatic tires. This tractor-scraper outfit hauls 30 heaped yards at average speed of 17 m.p.h. over ordinary ground conditions. Use of pusher tractor when loading decreases loading time as much as 50 to 60 per cent and increases payload as much as 20 per cent.



DEMOLITION OF SIXTH AVE. ELEVATED railway line, after 60 years of continuous service, was begun in New York City last December by Harris Structural Steel Co. which paid $40,000 for structure and will sell it as scrap. Contractor plans to complete removal of historic structure in 90 days. At left, crane with special boom extension is lowering portions of abandoned track structure to trucks in street below, while at right steel girders are being dismembered with cutting torches.



HUGE STEEL PIPES, each 15½ ft. in diameter and weighing 42 tons, will carry All-American Canal across New River, 1½ mi. west of Calexico, Calif. Project under construction by U. S. Bureau of Reclamation covers 80-mi. route delivering water to Imperial and Coachella Valleys.

BLAST HOLES at site of U. S. Bureau of Reclamation's Shasta dam across Sacramento River canyon in California are put down by battery of pneumatic-tired wagon drills, served through steel pipe and armored hose by an 8-unit air compressor plant supplying 11,000 cu.ft. per minute. Contractor on $36,000,000 project is Pacific Constructors, Inc., with Frank T. Crowe, general superintendent.

AUTHORS OF PRIZE PAPERS (right) receive awards at annual meeting in New York City, Jan. 18, of American Society of Civil Engineers. Winners are (left to right): DOUGLAS M. STEWART, engineer, Ingersoll-Rand Co., New York City (Collingwood Prize); CHARLES M. NOBLE, assistant engineer, Port of New York Authority (Wellington Prize); HUNTER ROUSE, U. S. Department of Agriculture, Pasadena, Calif. (Norman Medal); President HENRY E. RIGGS, University of Michigan; E. C. HARTMANN, Aluminum Research Laboratories, New Kensington, Pa. (Croes Medal); LEON S. MOISSEIFF, consulting engineer, New York (Laurie Prize); ALFRED HAERTLEIN, Harvard Graduate School of Engineering, Cambridge, Mass., chairman of Committee on Awards.

PUBLIC RELATIONS

Form Important Part of California Highway Division's Activities

By EARL LEE KELLY,

Former Director, Department of Public Works, State of California

EARL LEE KELLY (right), author of the accompanying article and former director of California's Department of Public Works, dedicates the Manchester Boulevard in Los Angeles.

CALIFORNIA MOTORISTS contribute millions in gas tax payments and motor vehicle fees annually for construction and maintenance of the state highway system. Naturally, they are entitled to know how these funds are expended. The policy of the Department of Public Works, as developed under Governor Frank E. Merriam, whose term of office ended Dec. 31, 1938, is to keep the people of California fully informed concerning the uses to which road funds are put and to safeguard these funds against diversion of any sort.

The California Division of Highways has under its jurisdiction approximately 14,000 mi. of state highways, planned, constructed and maintained by 6,000 men, and expends approximately $32,000,000 of state funds per year. The division appreciates that a great responsibility of trust rests upon its shoulders and maintains, therefore, a careful program of public and employee relations to the end that both the public and the employee will be properly informed of the execution of that trust.

A public agency of the magnitude of the California Division of Highways, must break itself down into departments and divisions so that operations will be handled efficiently and expeditiously. The State Highway Engineer, who is also Chief of the Division of Highways, is directly responsible to the Director of Public Works. Under the direct supervision of the State Highway Engineer, the several departments of the Division of Highways include the following:

Surveys and Plans	City and Cooperative Projects
Headquarters Office	Safety
Construction	Equipment
Maintenance	Accounting
Materials and Research	Districts, 1—11 (Each in charge of a District Engr.)
Bridges	

Recently there has been added the Department of Safety, a coordinating department, which considers the traffic problem from all angles, transmitting its findings to the appropriate operating department. All departments and their respective heads are readily accessible to the public, and courtesy is shown to every visitor.

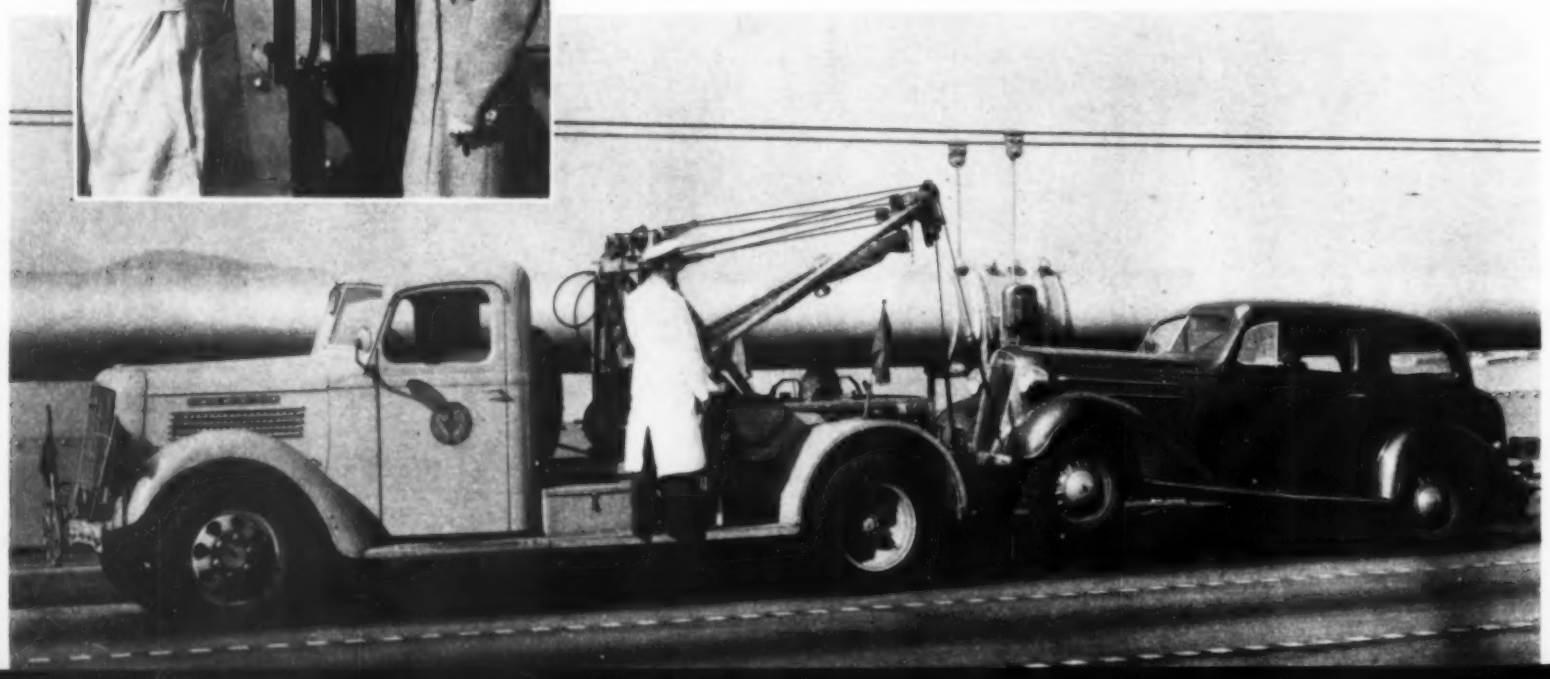
Policy Toward Public

The public is always welcome to the several departments of the Division of Highways, and when pertinent questions arise, every effort is made to answer them satisfactorily. Questions of particular interest to any particular department of the division are answered by the interested department, as is indicated further on in this article.

To keep the public generally informed as to the activities of the Division of Highways and other divisions of the Department of Public Works, the director of the department maintains a publicity department and publishes an official journal of the department, known as *California Highways and Public Works*. This publication, illustrated with photographs and diagrams, now has the circulation of 17,000 copies. Letters received by the editor indicate that the magazine is much appreciated by individuals and, too, is used extensively throughout California and the West in schools and colleges. The press of California also uses this monthly publication as source material for many rewrite columns. *Cali-*

PUBLIC'S INTEREST is served in operation of San Francisco-Oakland Bay bridge. Service call boxes **(left)** along roadway make it easy for motorist to summon tow-car in case of flat tire or mechanical trouble.

TOW-CAR SERVICE (below) is maintained on San Francisco-Oakland Bay bridge as aid to motorists in trouble.



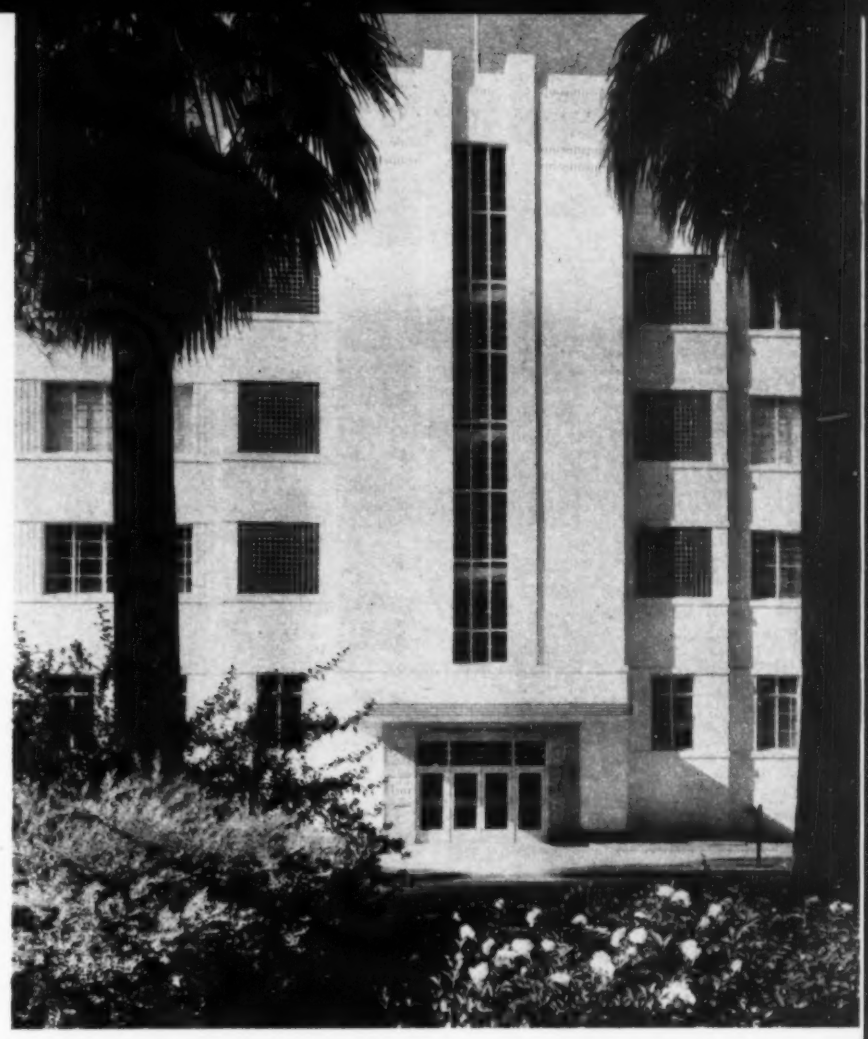
fornia Highways and Public Works, by story and by photograph, brings to the public a review of the activities of the department, indicating the completion of new highway construction, visualizing the need of future construction, and arousing in the mind of the taxpayer a keen and active interest in *his* California highways. Late issues have given construction reports of recently completed projects that relieve congestion in and near metropolitan areas. A complete story has been shown in the past and is being continued on the San Francisco-Oakland Bay bridge, more recent articles being in connection with the construction of the bridge railroad and its terminal facilities.

California, which is keenly interested in and proud of its scenery, has an Outdoor Advertising Act. This act controls and limits the extent to which outdoor advertising signs may be placed. The operation of this act is under the jurisdiction of the Division of Highways. A recent article in the magazine reported to the public on the activities of this department.

For the benefit of engineers, both in the state and other public services, articles appear frequently on engineering aspects of highway construction. Such stories as soil stabilization, the control of roadside vegetation, traffic striping, traffic survey studies and counts, have been published. A recent series of articles on "Scientific Engineering and Its Relation to Accident Prevention" has appeared, and it is contemplated that additional information will be published in an effort to reduce the traffic toll on the highways of California.

In addition to the publication of an official journal the publicity department of the Department of Public Works prepares press releases, which are given to the wire services and frequently mailed to 700 newspapers. Statistical items as to traffic on highways, accidents, expenditures for improvements, and cost of maintenance are of much interest to the public. Frequently such items are prepared and released. The Department of Public Works, and especially the Division of Highways, contains and creates much of public interest, and therefore the press keeps in close contact with the department for current news items.

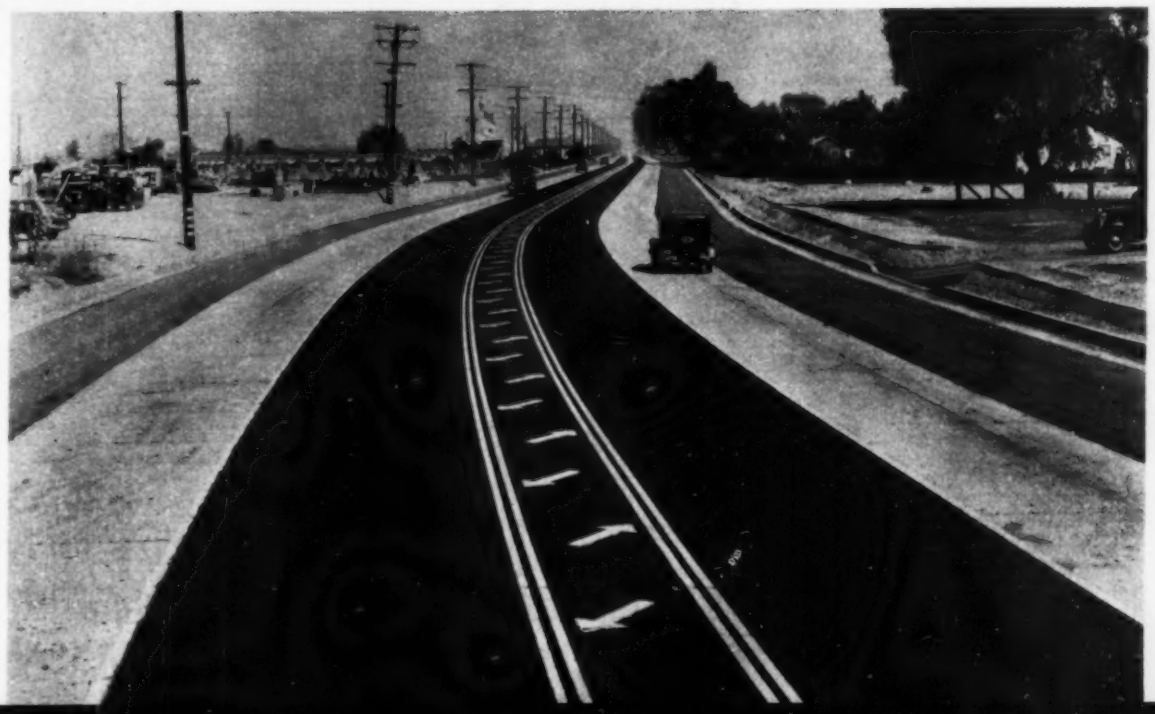
That it may be informed properly, the California Highway Commission of five non-salary members travels as required into the territories where construction is contemplated or where highway activity is requested by the local residents. As a general rule the commission holds open meetings and listens to the requests or arguments of the local people so that in a round-table discussion the public can be well informed as to the availability or lack of funds, and as to the possibilities of construction or maintenance by the Division. Yearly, requests far in excess of funds available are made by the people. By a clear, open-handed presentation of the facts, the Highway Commission is able to obtain the cooperation of the people interested so that, by careful planning, the moneys available are expended wisely.



PUBLIC WORKS BUILDING in Sacramento houses headquarters of California Division of Highways.

SEPARATING STRIPS and painted guide lines on 4-lane routes reduce motor vehicle accidents on California highways.

SAFETY MEASURES (below) include separation of traffic by central lanes marked with raised white arrows.



SERVICE TO TRAFFIC requires operation of snow removal equipment to keep open state route on Donner Summit.

Public Contacts During Survey Period

Old time engineers tell of their experiences when running lines across private property. They were met with shotgun brigades and vicious dogs. The property owner of yesteryear considered a new railroad or a new highway a liability rather than an asset. Today the modern highway is an improvement much coveted by the average land owner.

As soon as new alignment is determined, property owners are approached by the right-of-way agents of the districts, who have, in the meantime, made their appraisal of the land involved, and negotiations for the right-of-way are undertaken. If the final location is definite, the writing of descriptions for right-of-way deeds is begun and the closing of agreements obtained. As a rule a considerable period of time is allowed for the right-of-way negotiations, and adequate opportunity is given the owner to express his ideas and to study the situation. Usually the owner is fairly well informed as to the general location of the line and approximately how much his property will be affected. In a friendly discussion of the situation it is not difficult to come to an agreement.

It is to be noted here that out of the California 3c. gasoline tax, ¼c. is allocated to municipalities for state highways within incorporated limits, and an additional ¼c. is allocated to cities on principal streets within the same incorporated areas. One cent goes to the counties, leaving 1½c. for the state Division of Highways.

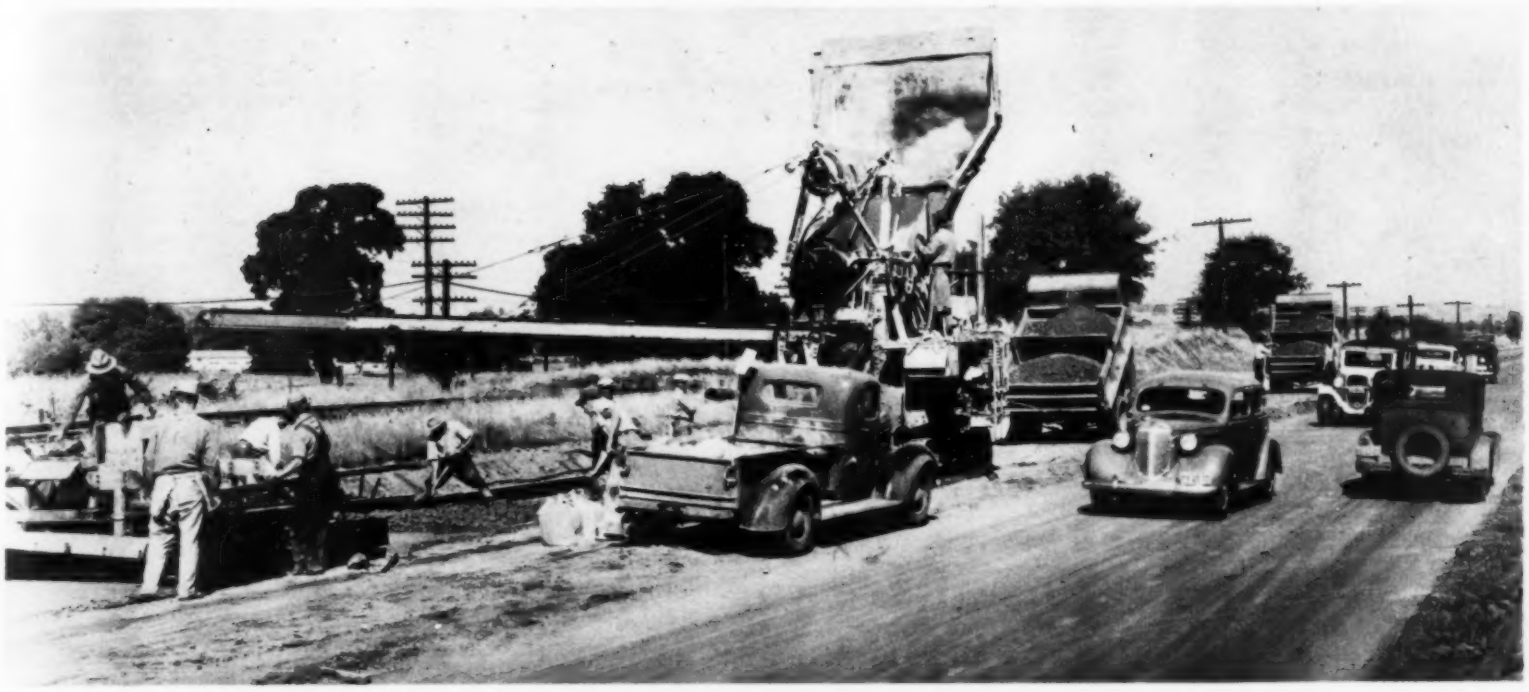
After proper examination by the engineers as to the proposed highway routing through the cities, if the recommendations by the governing bodies or the city authority are sound from an engineering view point so as to serve traffic properly and allow adequately for the development of present and future improvements, these recommendations are accepted. In the event that differences of opinion arise within the city from different groups, the California Highway Commission has adopted the attitude that the main consideration should be given to the request originating with the governing body.

In all of these activities preliminary to construction, much thought and attention is given to public opinion. Opportunity is afforded to everyone to be heard, and serious consideration is given to the opinions expressed. The Division of Highways appreciates that the public relation obtained during the preliminary period of construction is a most important factor and expends every effort to promote a proper and sincere feeling.

Prior to Construction

The California Division of Highways endeavors to prepare and present a precise set of plans and specifications for the contractors' benefit, so that misunderstandings and questions of construction details may be reduced to a minimum. The procedure of bid opening has been perfected through an experience of 26 years. After plans and special provisions for a proposed highway or bridge construction project have been prepared, the project is released for advertising. A notice to contractors

GRADE-CROSSING ACCIDENTS are eliminated by construction of underpasses like this at Stockton



BY-PASSING OF TRAFFIC around construction operations is made easy for motorist by building parallel detour routes surfaced with oil mix.

calling for bids (briefly describing the work, and giving the minimum prevailing rate for wages to be paid workmen on the contract) is published for at least two or three consecutive insertions one week apart in a trade journal in San Francisco or Los Angeles, and in a newspaper of general circulation in the county in which the proposed work is to be performed. To further a wide dissemination of the call for bids, printed copies of the notices are mailed to contractors and materials vendors who are interested in bidding on highway work. At the present time this mailing list includes between 700 and 800 names. Because of the geographical length of California, bids for the southern part of the state are opened in Los Angeles, while bids for the northern portion are opened at the central office in Sacramento.

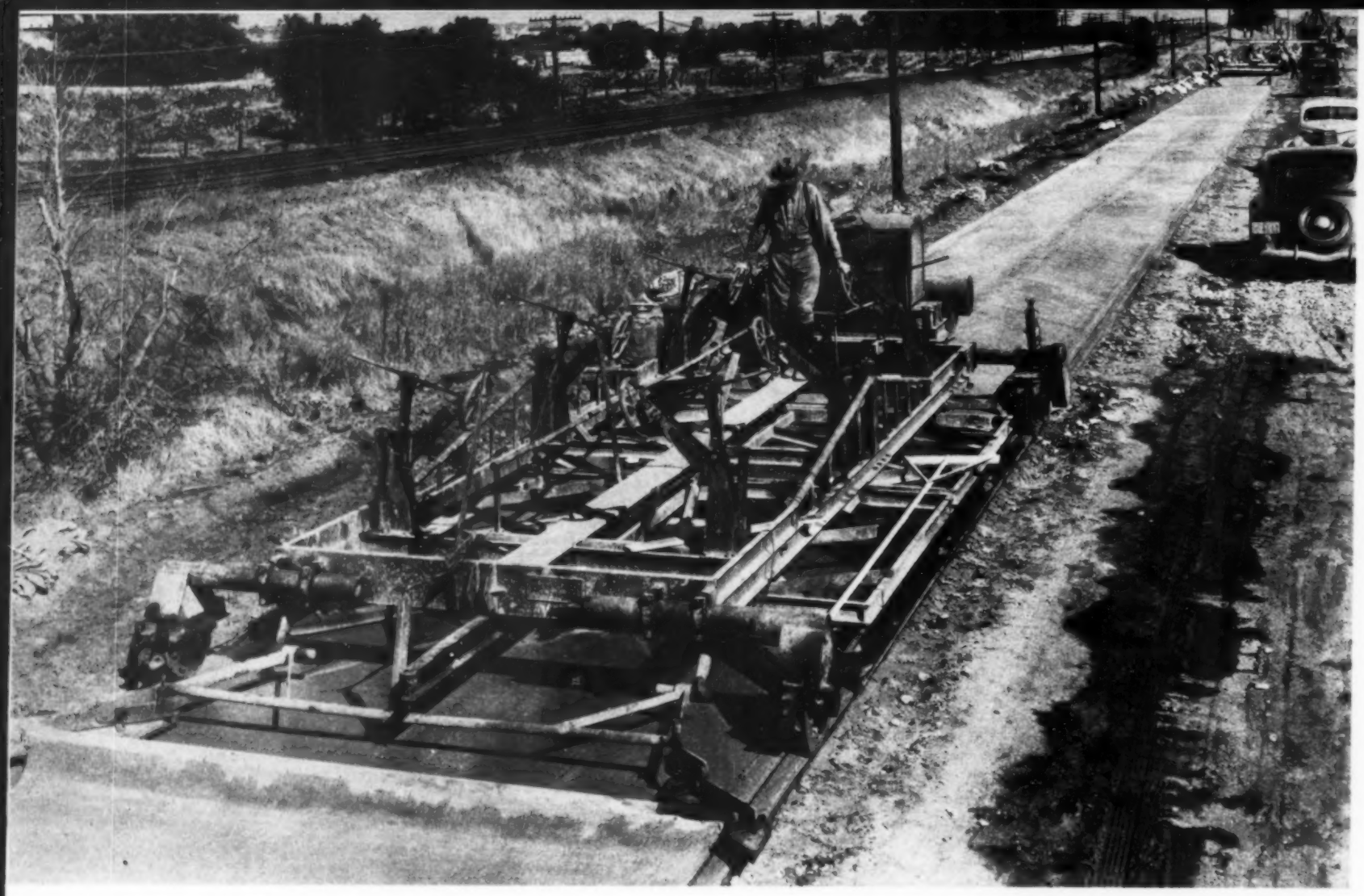
At the time and place stated for the bid opening the State Highway Engineer or his representative, with whom the sealed bids are filed, opens the bids publicly. The extensions of the several items are carefully checked and a bid summary sheet compared for each project. The summary sheet lists the items and the name of each bidder, giving the prices, the extensions, and the totals of each bid. A copy of this sheet is mailed to each bidder as well as to the several trade journals and others interested in bidding. This procedure does much to preclude misunderstandings and likewise gains much in contractor appreciation.

During Construction

The personnel for the proper supervision and inspection of the state's

(Continued on page 78)

COLORFUL PUBLIC CEREMONIES mark the dedications of important state routes. Director Earl Lee Kelly severs barrier that opens up newly constructed Los Gatos-Santa Cruz highway.



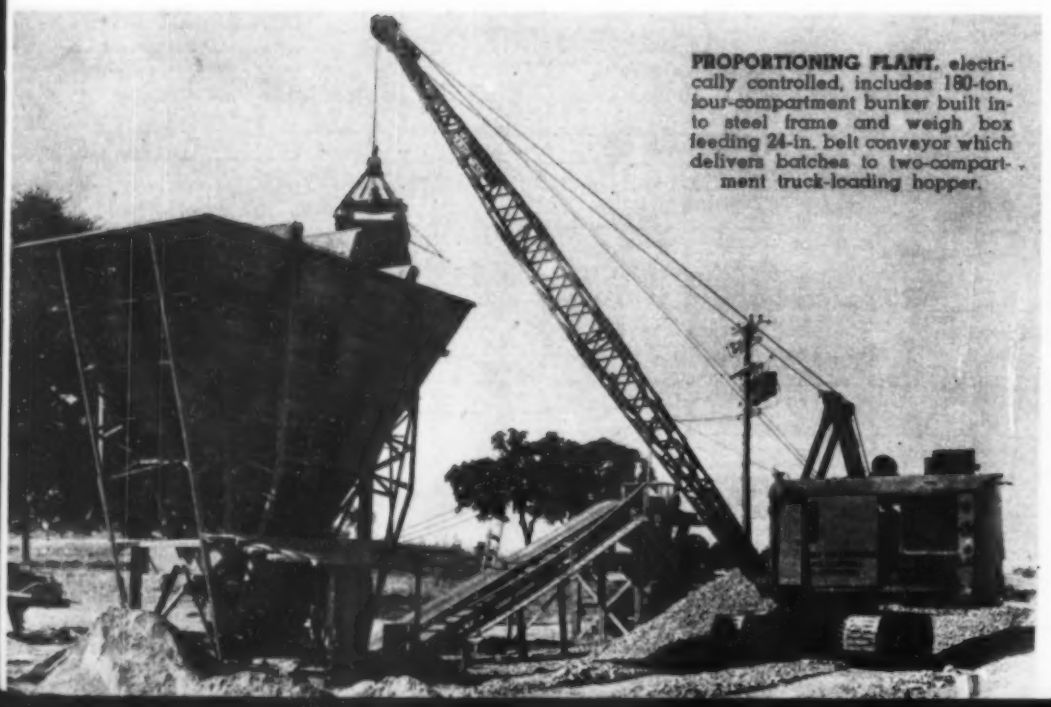
MECHANICAL DRAG FLOAT operating on last forward pass with belt down. Section of pavement ahead of machine has not as yet been finished.

Mechanical Drag Float

PRODUCES SMOOTH CONCRETE PAVEMENT

By H. A. WATERMAN

Assistant Construction Engineer, California Division of Highways

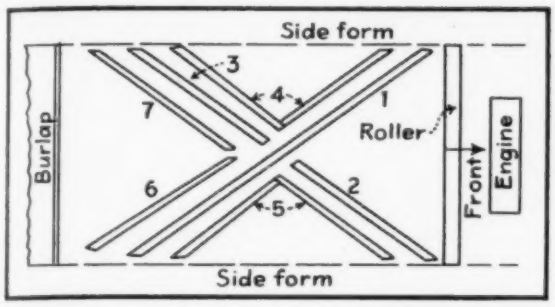


PROPORTIONING PLANT, electrically controlled, includes 180-ton, four-compartment bunker built into steel frame and weigh box feeding 24-in. belt conveyor which delivers batches to two-compartment truck-loading hopper.

OF UNUSUAL INTEREST to highway engineers and equipment men generally was the Fredericksen & Westbrook highway grading and paving contract, completed late last year in the foothills near Sacramento, Calif. The type of construction was ordinary and excited no particular interest, but the assembling of several pieces of up-to-date, time-saving equipment, not ordinarily found on a small highway job of this kind ($87,000), did attract considerable attention.

The project, located between Roseville and Rocklin, about 20 mi. east of Sacramento, consisted mainly of constructing a graded road bed and placing thereon a 22-ft. width of standard 5-sack portland cement concrete pavement as now constructed by the California Division of Highways. The overall length was about 2.7 mi. As the road is a portion of U. S. 40, the main highway over Donner Summit to Reno, the grade was constructed, over a large portion of the distance, about 18 ft. wider than standard section in order to accommodate traffic alongside the work and, at the same time, provide for future development. In this connection, the concrete pavement was uniformly sloped to the north with the idea that future additions would be sloped in the opposite direction.

Detour Quickly Prepared—As soon as grading permitted on the south half of the roadway, a road-mix two-way detour was constructed beside the existing pavement throughout the length of the widened grade portion, traffic using the old pavement until the detour was ready. In the preparation of this temporary surfacing, a commercial multiple-blade drag, supplemented by a reversible-blade motor patrol, was used to mix the natural



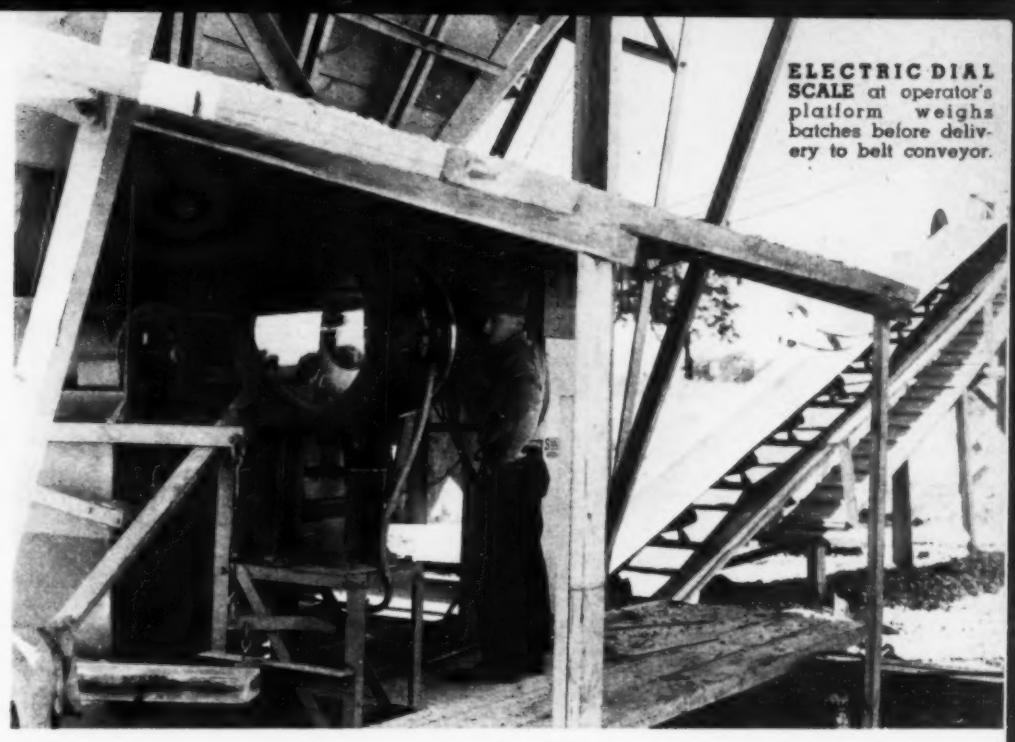
ROUGH SKETCH, not to scale, indicates approximate arrangement of screed units of mechanical drag float.

soil and selected material with an application of 1.77 gal. per square yard of SC2 liquid asphalt. This mixture, when bladed into place and compacted with an 8-ton tandem roller, provided a smooth, dense surfacing, without any seal, about 2 in. thick which lasted throughout the job with very little maintenance.

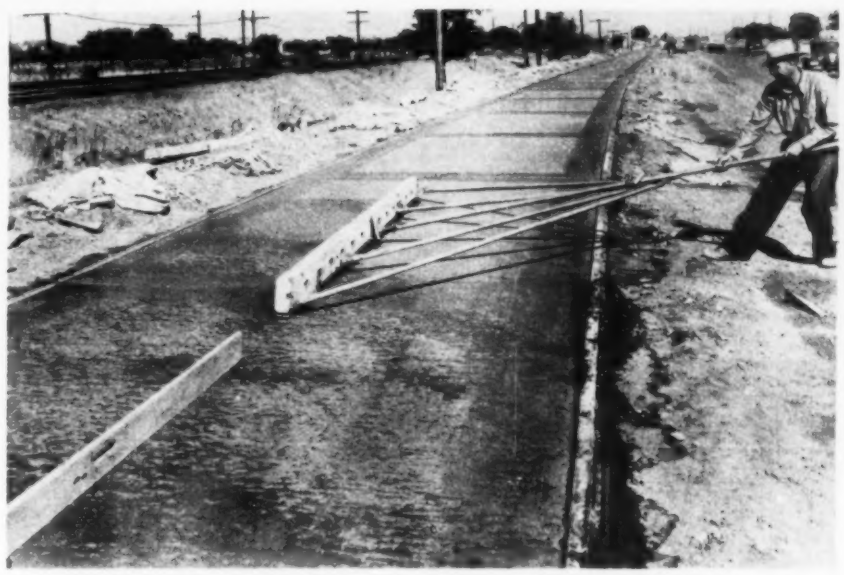
Traffic counts taken on this road last July totaled 6,300 vehicles on Sunday and 4,285 vehicles the following Monday. Although construction operations were but several feet removed, the detour was remarkably free from accidents during the entire time it was in use. After the pavement was completed the detour surfacing was salvaged and moved over adjacent to the nearest oil-mixed pavement border.

Proportioning Plant — Commercial aggregates from the American River were hauled 13 mi. by truck and stockpiled at the west end of the job where the proportioning plant was erected. From the first, the contractor recognized the fact that a quick and efficient method of weighing and proportioning would be necessary to get the most out of his contract. He accordingly suggested to one of the Los Angeles equipment manufacturers the use of this company's regular electrically controlled, automatic 5,000-lb. asphalt concrete weighing assembly

(Continued on page 72)

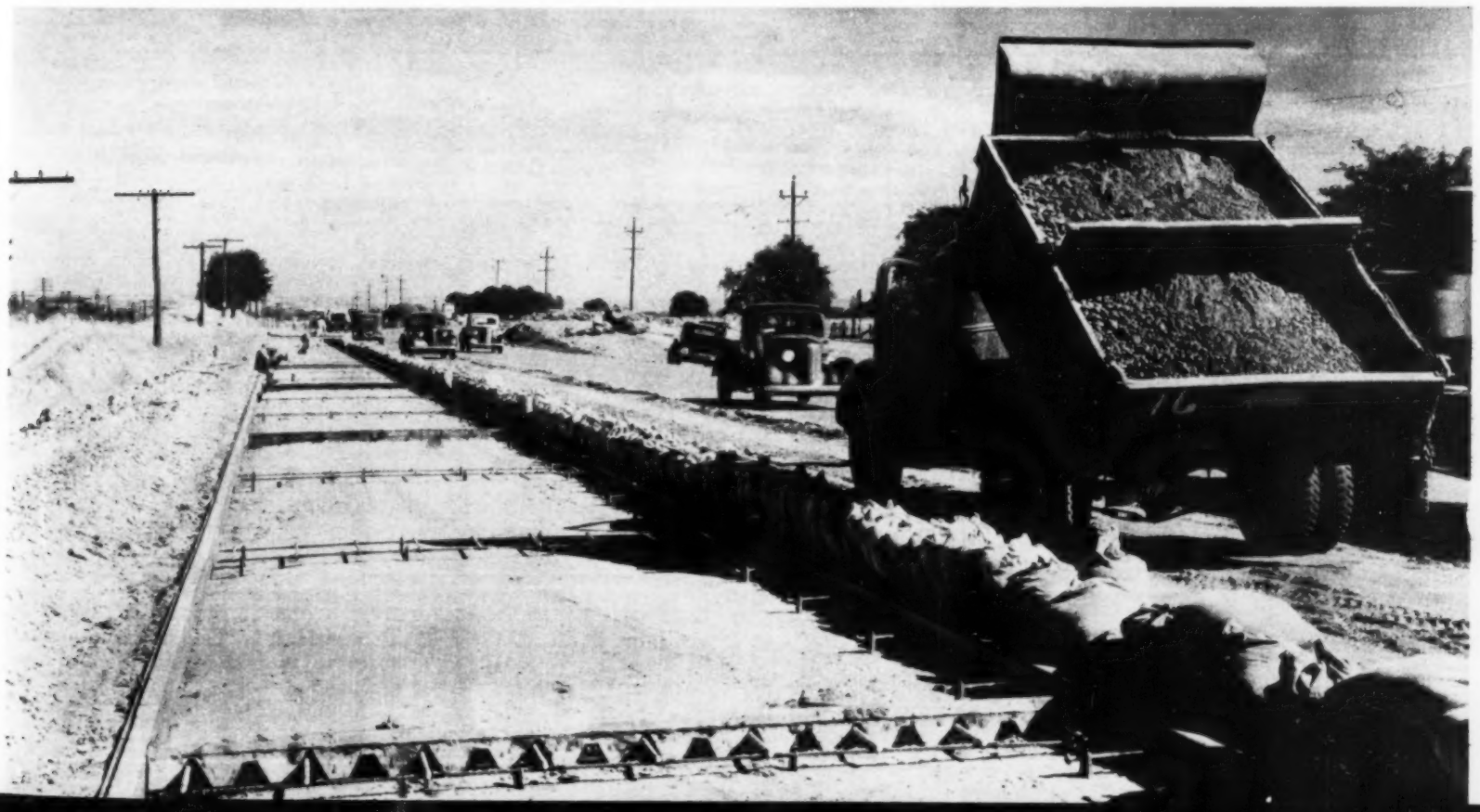


ELECTRIC DIAL SCALE at operator's platform weighs batches before delivery to belt conveyor.



STEEL-SHOD CUTTING FLOAT, 16 ft. long, is operated 4 or 5 hr. behind mechanical drag float. Straight-edge in foreground shows almost perfect finish. Dark streaks beyond float are marks left by broom finish of joint edging.

PREPARED SUBGRADE (below), with dowel assemblies in place ahead of mixer, is ready for concreting. Note joint-holding device in foreground and tie-bolt assemblies fastened to right side forms.

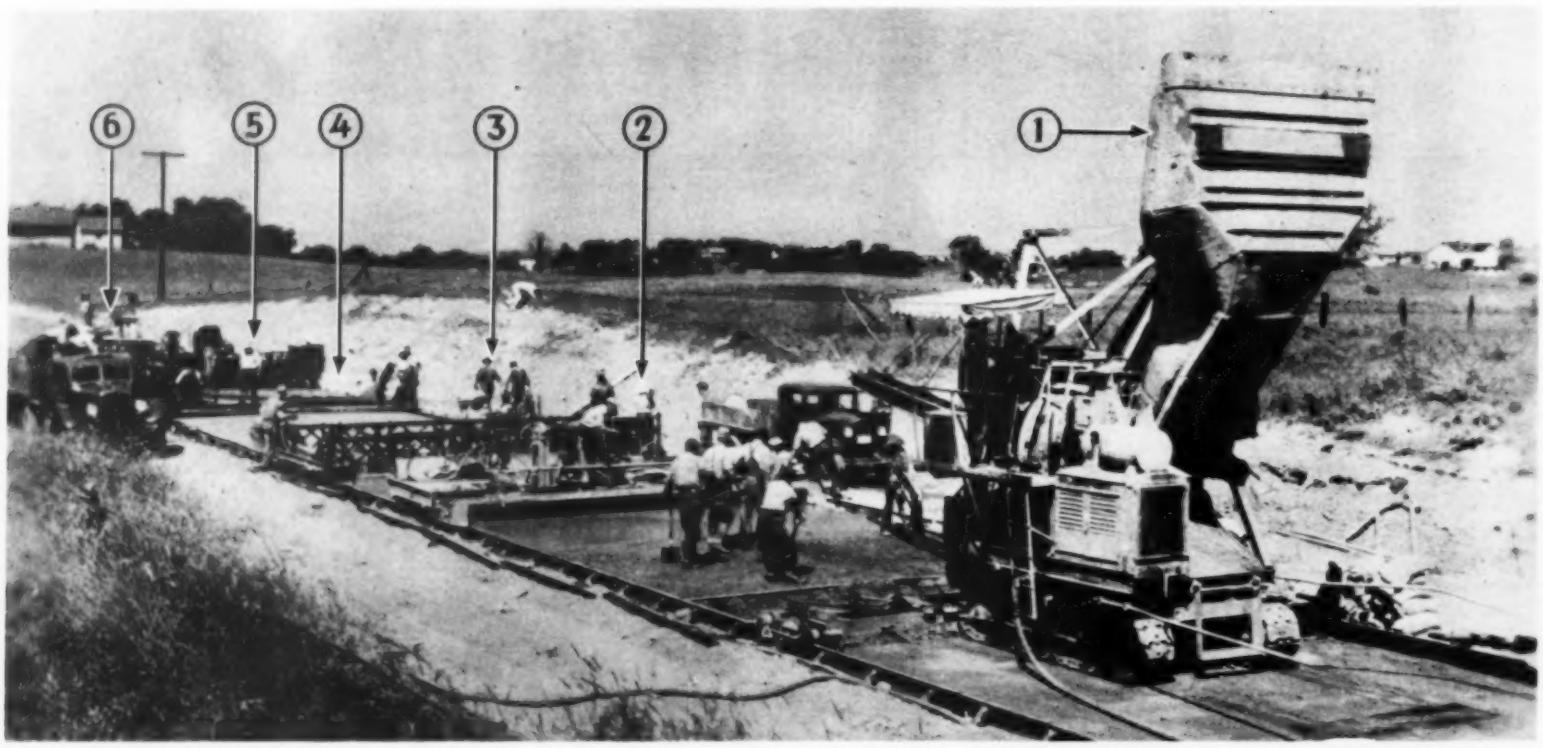


Monolithic Brick Pavement

Vibrated to Smooth Surface and Bond With Plastic Concrete Base

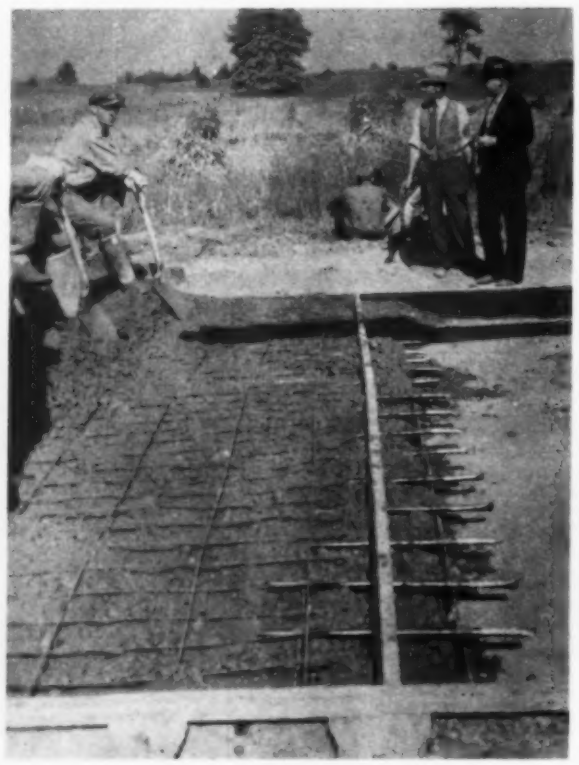
By V. K. GAMBLE

Secretary, Ohio Paving Brick Manufacturers Association, Columbus, Ohio



TRAIN OF MECHANICAL EQUIPMENT includes, right to left: (1) Concrete paving mixer; (2) vibratory finishing machine of gas-electric type; (3) machine for installing ribbon center joint of ⅛-in. premolded bituminous material; (4) roller carrier delivering brick from truck to droppers; (5) vibrating machine for smoothing paved surface and bonding brick to plastic concrete; (6) cement-sand grout mixer for joint filler.

TRANSVERSE JOINT assembled with dowel bars in place **(below)** and in permanent position on subgrade **(right)** ready for concreting.



A MONOLITHIC BRICK PAVEMENT 2.2 mi. long, completed in October, 1938, on State Route 21, just south of Canal Fulton, Stark County, Ohio, is illustrative of the improvements in highway construction methods made possible by use of modern construction machinery. Throughout the construction of the project from earthwork, where two 12-yd. and one 8-yd. LeTourneau scrapers pulled by Caterpillar diesel tractors were used, to the final grouting of the brick pavement surface the operations were highly mechanized. Other interesting developments were the use of full-depth transverse expansion joints of recent design, bituminous premolded ribbon center joint material, and a vibrating machine to produce smoothness of surface and bond the brick to the fresh concrete base.

After completion of the rough grading a form-trenching machine was used to set 9-in. steel road forms

to line and grade. Operating from these forms the fine grading was then accomplished by use of a Lakewood subgrader pulled by a tractor.

The 27-E Multifoote paving mixer was charged from trucks carrying two 5-sack batches of 1:7½ concrete aggregates. Following directly behind the mixer and riding on the steel road forms were a subgrade planer and pin scratch-templet for final checking of the subgrade.

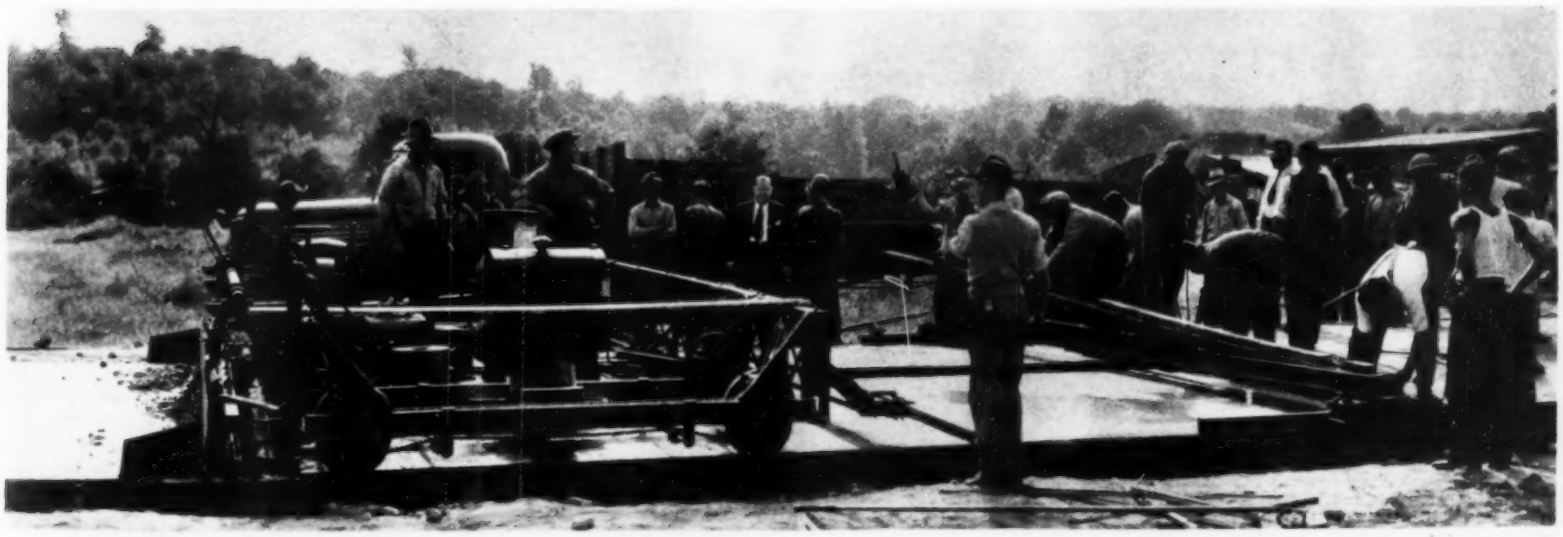
Vibratory Finisher — The concrete base, of 9-7-7-9-in. section, was spread and finished with a Flexible Road Joint Machine Co. vibratory finisher, which also served to strike off the concrete 2 in. below the side forms on the first pass to permit placing of the wire reinforcing steel mats. This finisher was of the gas-electric type and had mounted on the screed three electric vibrator units operating at a frequency of 3600 pulsations per minute.

Expansion Joints — The bottom portions of the transverse expansion joints were assembled in wire cages with the dowel bars in place and were installed in back of the mixer at 60-ft. intervals. This bottom portion consisted of 6 in. of 1-in. bituminous premolded material between two metal plates bent to form two extrusion chambers running the full length of the joint on each side. It was protected from infiltration of concrete by a metal cap and the concrete base finished to grade over the top of the joint assembly. As the machine for installing the ribbon center joint material, a Flexplane joint machine, passed over each transverse joint after placing the ribbon material, it was stopped, the metal cap protecting the expansion joint removed and a 3½-in. width strip of 1-in. premolded cork placed vertically in position above the lower portion of the expansion joint assembly.

The ribbon center joint, of ⅛-in. premolded bituminous material 5½ in. in width, was placed 2½ in. into the base to create a plane of weakness designed to control longitudinal cracking and the remaining 3 in.

FORM TRENCHING MACHINE prepares subgrade for setting 9-in. steel forms to correct line and grade.

FINISHING MACHINE for concrete base is of gas-electric type, with three electric vibrator units mounted on screed.



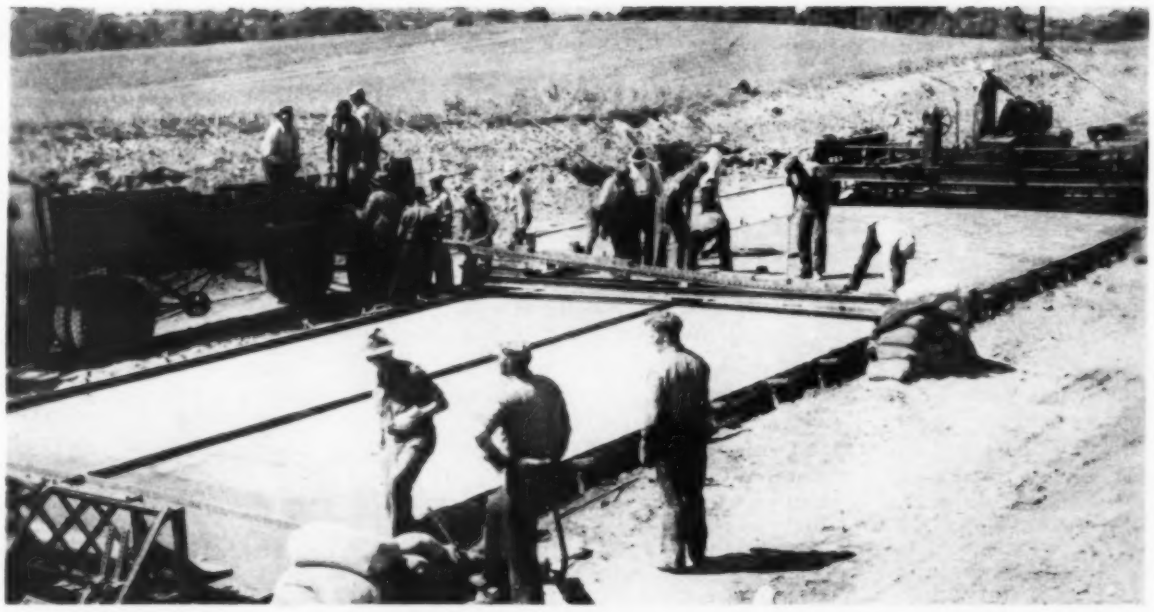
CENTER JOINT MACHINE placed ⅛-in. ribbon of premolded bituminous material, 5½ in. in height, to depth of 2½ in. in concrete base to form plane of weakness. Brick droppers, at right, follow close behind joint machine.

were held in place vertically by means of oiled steel plates. These plates were pulled out as the brick were laid.

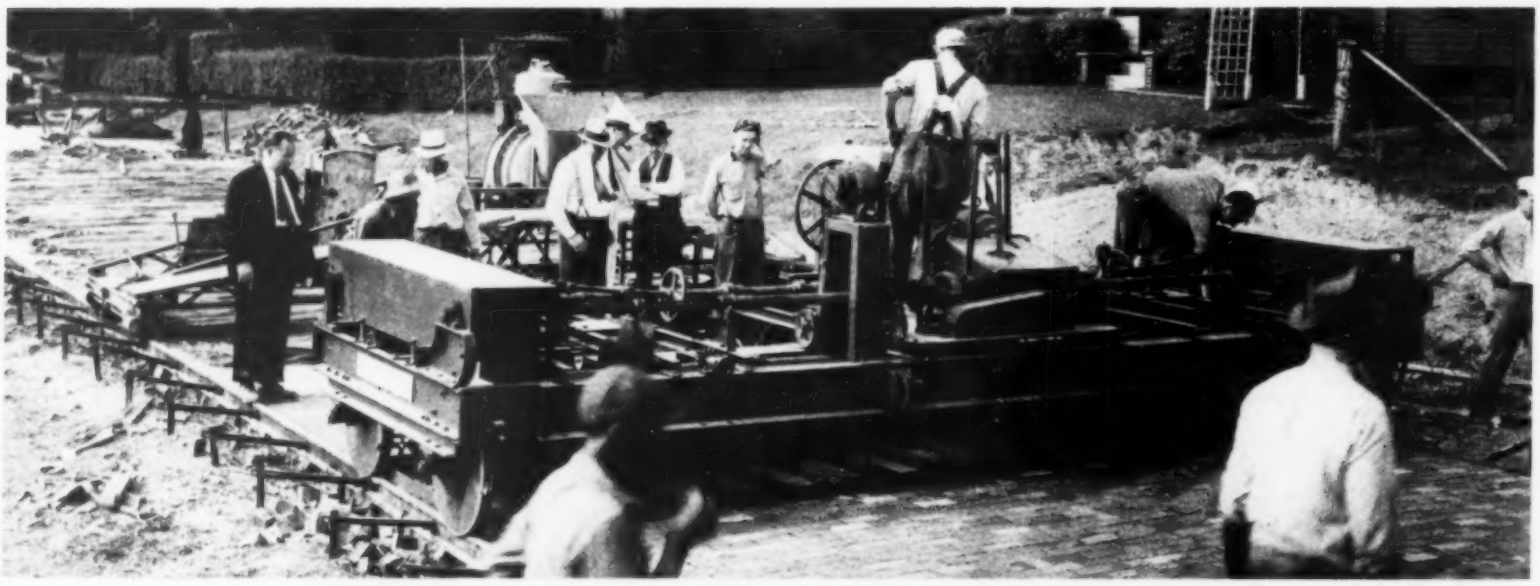
After the surfacing of the concrete base was completed, a 3½-in. extension form was securely clamped and braced on top of the 9-in. road forms. The roller carrier for the brick, the brick vibrating machine and the grout mixer operated from the extended road forms. Both the 9-in. forms and the 3½-in. extension were furnished by the Heltzel Steel Form & Iron Co

Laying Brick — The brick, 3 x 4 x 8½-in. vertical fiber units with end and side lugs, carried to the droppers on a roller carrier fed directly from brick trucks on the berm, were laid on the plastic concrete base from 1 to 3 hr. after it had been placed,

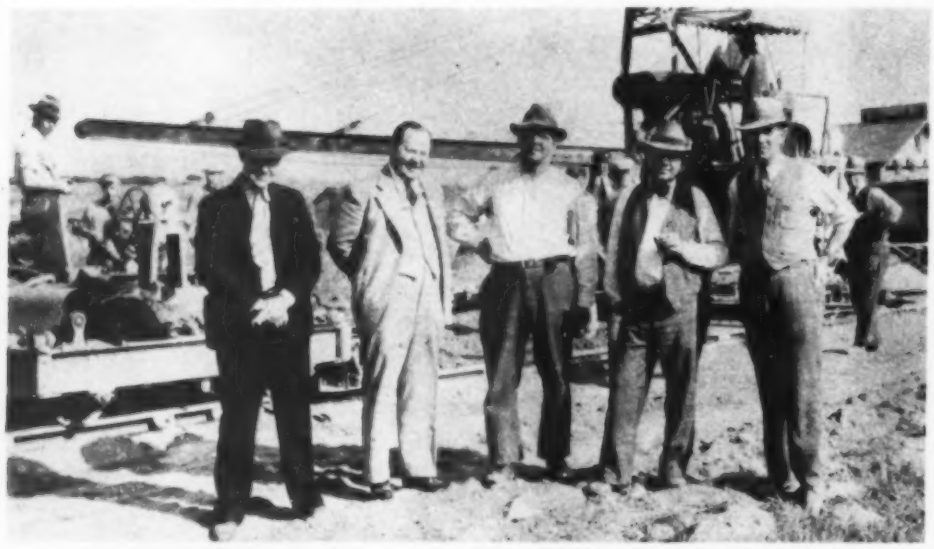
(Continued on page 88)



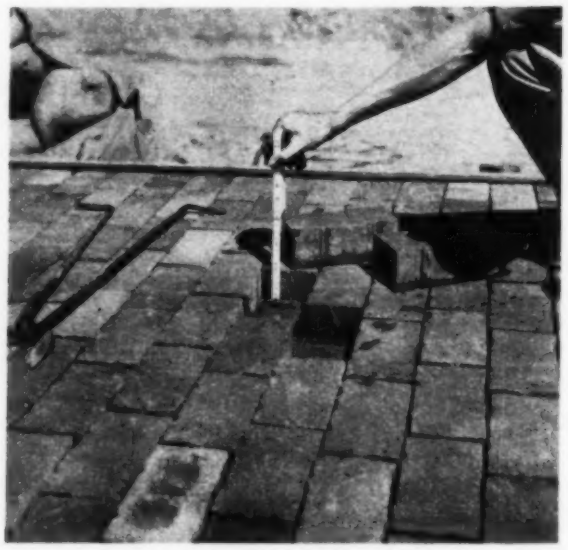
BRICK from truck is delivered to droppers by inclined roller carrier. Note top of centerline joint ribbon extending above surface of concrete base.



BRICK VIBRATING MACHINE, riding on 3-in. side form extension rails, smoothes surface and embeds brick in plastic concrete base. Row of 12-in. steel channels mounted on beam spanning pavement is vibrated by four electric vibrator units.



CONSTRUCTION PERSONNEL on job includes, left to right: W. L. BELKNAP resident engineer; F. McCAFFREY, manager, Flexible Road Joint Machine Co.; E. O. VOGT, contractor; W. L. BARR, Metropolitan Paving Brick Co.; and L. L. LUKE, project engineer.



PENETRATION of brick into concrete base, due to vibration, ranges from 1/16 to ⅛ in. Mortar is forced up into joint from ¼ to ¾ in.

Power Shovels and Track Wagons

Handle Heavy Grading on

BLUE RIDGE PARKWAY

TYPICAL GRADING OUTFIT of Chandler Bros. Co. on section of Blue Ridge Parkway utilizes tractor-drawn crawler wagons to transport spoil from power shovels on hauls up to 1,000 ft.

GRADING OF THE 500-mi. Blue Ridge Parkway, which extends through Shenandoah National Park in Virginia, near Washington, to the Great Smoky Mountain National Park on the Tennessee-North Carolina line, has been completed for nearly 225 mi. Work is well advanced on an additional 80 mi., with funds available to let some 25 mi. more. By the end of 1939 it is expected that about 275 mi. of this great scenic route will be open for traffic, although not all of this total mileage will have been paved by that time.

Plant and methods used in grading this unusual highway undertaking have been dictated largely by the heavy grading involved, much of it in hard rock, and by the broken and irregular mountainous country through which the location passes. No unique methods have been developed, but selection of plant for the different conditions encountered has become well standardized by experience.

Power Shovels—Crawler-mounted, diesel-powered shovels, equipped with 1½-yd. dippers, are used with few exceptions on the sections of the project on which grading is now under way. In exceptional cases, 2-yd. dippers are employed on shovels of this type.

On some of the earlier work a few smaller shovels were used; one contractor is still operating a ¾-yd. outfit on light grading. But the larger units have proved more satisfactory for the heavy rock work involved on practically all sections.

Some sections of the project run from 65 to 95 per cent rock and cost from $50,000 to as high as $100,000 a mile. These heavier sections are all in steep, broken country, with much of the line on abrupt slopes and precipices. As the roadway has a minimum width of 20 ft., with wide shoulders on both sides, quantities run high.

Track Wagons — On the heavier sections, and also on the heavy work on other sections, experience has shown that crawler-mounted 8- to 10-yd. steel dump wagons hauled by crawler tractors give best results. On most of the active jobs which involve the conditions mentioned, this type of haulage equipment is being used almost exclusively. One contractor on a heavy section has employed round-wheel equipment on some of his work, but in this case such equipment was available and would otherwise have been parked for lack of placement on other jobs.

Specifications call for 1,000-ft. free haul of spoil from cuts. This maximum length of haul has proved entirely practical with the crawler-

TRACTOR-BULLDOZER with blade set at angle spreads rock spoil dumped by crawler wagons.

IN EARTH CUTS (left) as well as rock cuts on heavy grading sections of Blue Ridge Parkway, power shovels and tractor-drawn track wagons move material for Nello L. Teer.

mounted, large-capacity dump wagons, the average haul from each cut being considerably less than 1,000 ft. Beyond a 1,000-ft. haul the cost of operating the large crawler-mounted dump wagons has been found to increase rapidly, that length of haul being about the limit of efficient operation under the conditions on this project.

Carrier Scrapers — Round-wheel, rubber-tired, large-capacity carrier scrapers, handled by crawler-tractors, have been used extensively by contractors having sections that were largely in earth. This type of haulage equipment also has proved best adapted to somewhat limited areas between the heavier rock cuts.

Motor Trucks — Standard dump trucks were employed to some extent in the earlier work on the project. Isolation from adequate service and the broken character of the country, with steep side slopes on the line, handicapped this type of haulage equipment. Necessity for operating over rough rock fills, in which shovel spoil had to be placed, also cut the usual efficiency of standard round-wheel dump trucks. The combination of conditions has almost entirely eliminated this type of equipment on the mountainous sections of the project, which make up practically all of the undertaking. Motor trucks are being used extensively, however, in delivery of materials and supplies to all of the work under way, the contractors in most cases opening up their own access roads.

Pioneer Roads—On account of the isolation of practically the entire project in sparsely settled high mountain areas where good existing public highways are scarce, common practice has been to start operations from the nearest usable public road and to

ROCK CUT on typical grading section of Nello L. Teer requires drilling and blasting in advance of excavation by power shovels.

DIESEL-POWERED CRAWLER EQUIPMENT excavates and hauls rock on grading contract of M. E. Gillioz, Inc.

work ahead on the line. In practically all cases it is necessary to drive a pioneer road to get the rock drilling equipment in position on heavy cuts in advance of the shovel.

It is usually possible to locate the pioneer roads so the work done on them may become part of the finished job. In some instances, however, the rugged country makes it necessary to locate these access roads wherever the terrain will permit, often entirely off the right-of-way of the main job.

Portable compressors supply air for the drilling operations, no fixed outfits being employed. Most of the compressors are mounted on rubber tires to facilitate shifting. Even in the most rugged country, these mounted compressors are hauled ahead of the shovel operations over the pioneer roads by crawler-mounted tractors.

Structures — Waterways are limited on the entire project, since the line follows for almost its entire distance the crest of the Blue Ridge. Concrete box culverts and precast concrete pipes are used for such waterways as are required. Materials for these structures are delivered ahead of shovel operations over the pioneer roads.

On account of the very steep slopes frequently unavoidable in locating the project along the sides of high, rugged mountains, extensive retaining walls are required to hold fills in place. Rock from the excavation usually is employed in building these walls. Cement, and usually the sand for mortar, are brought in over the pioneer roads, the crawler haulage equipment making the deliveries.

Drilling Equipment—A variety of

(Continued on page 92)

LARGE BLOCKS OF ROCK handled by 8- and 10-yd side-dump crawler wagons reduce amount of secondary blasting required.

PNEUMATIC-TIRED CARRIER SCRAPERS drawn by diesel tractors prove most effective on this type of earthwork. Where conditions are suitable, scrapers excavate cuts as deep as 35 ft.

How They Did It

CONSTRUCTION DETAILS
For
Superintendents and Foremen

EXTERIOR ARCH FORMS for Bartlett multiple-arch dam on Verde River, Ariz., consist of steel-plate panels fitted with gore sections for reducing radius as forms move up in 15-ft. lifts to top of structure 286½ ft. high. Inner arch forms, of fixed 48-ft. radius, support working platform to which concrete is pumped for distribution by carts and elephant-trunk spouts into forms. Barrett & Hilp and Macco Corp. place 180,000 cu.yd. of concrete in job under $2,228,000 contract with U. S. Bureau of Reclamation.

43-YD. DIESEL TRUCK equipped with special tail gate (which permits loading to maximum capacity with any class of material) unloads in 45 sec. by means of sliding bulkhead in body that pushes load out and spreads it simultaneously. Built by Trojan Truck Mfg. Co., Los Angeles, Calif., and powered with Caterpillar V-8 5¾x8-in. diesel engine developing 180 hp. maximum at 1,100 r.p.m., truck has nine speeds forward and three reverse and rides on fourteen 13.50x24-in. Firestone twenty-ply excavator tires. Operating on Los Angeles flood control work, machine hauls two 42-yd. loads per hour on 2½-mi. round trip with fuel consumption of 3½ gal. In 120 hr., truck moves about 9,000 cu.yd.

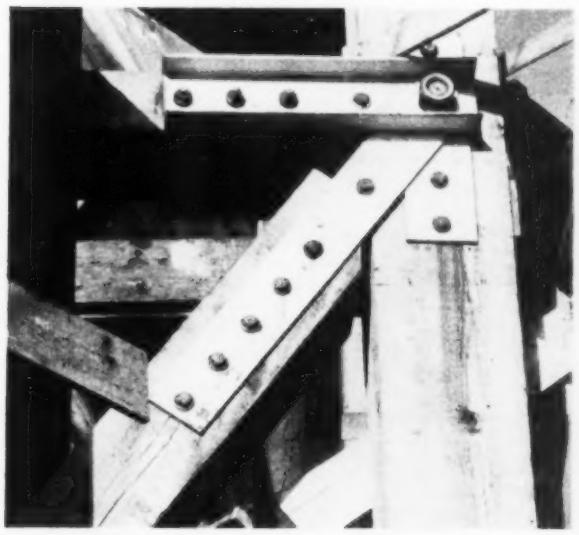
MULTIPLE TOOTH VIBRATOR is used by Sani Construction Co. of Des Moines, Iowa, on construction of widened section of highway paving in Ft. Dodge, Iowa. State's specifications require all concrete not passed over by finishing machine to be vibrated. To speed up operations this machine is used. It operates at frequency of 3,600 vibrations per minute and is powered by 3-hp. motor.—Photo from WILLIAM S. FOSTER, inspector, Iowa Highway Commission, Jefferson, Ia.

STABILIZED MIXTURE (right) containing gravel, clay and calcium chloride for state highway surfacing between Escanaba and Menominee, Mich., is produced at rate of 90 cu.yd. an hour by C. E. Bridges, Escanaba, Mich., with Cedar Rapids senior stabilizer plant.

COMPLETE MOBILE DRILLING OUTFIT of Harry T. Campbell Sons Co., Towson, Md., mounts Gardner-Denver compressor on Caterpillar diesel tractor and attaches universal wagon drill to left front end of tractor. Drill can operate at any angle from vertical to horizontal

REINFORCED BRICK PAVEMENT on Ohio test section consists of 8-in.-square brick laid in welded mat of 3/8-in. bars which are buried in cement grout joint filler. Pavement comprises stone base about 9 in. thick, 1-in. sand cushion, and reinforced brick surface, with grout filler squeegeed into joints. Brick are centered in mesh openings measuring 9 in. square, c. to c. of welded bars

IMPROVISED VIBRATORY SCREED used by A. I. Savin Construction Co., East Hartford, Conn., in paving concrete-filled armored floor of Middletown-Portland bridge across Connecticut River for Bethlehem Steel Co., superstructure contractor, consists of 10-in. I-beam drawn forward by ropes while two men behind screed push it ahead with pneumatic paving breakers which impart vibration. Little finishing work remains to be done after screeding is completed — Photo from T. H. SELLEW, JR., Cromwell, Conn.



STRAP-AND-PIN JOINT developed for timber frame structures by engineers of 1939 Golden Gate International Exposition works equally well in tension or compression. Stresses are transferred through flush shear-plates and bolts to metal and thence to other members through a pin-bolt connection. Joint requires minimum of steel, reduces secondary stresses, simplifies shrinkage compensation, facilitates erection and increased salvage value of timber.

TRACK-MOUNTED CARRIER SCRAPERS (left) navigate mud and slime dredged up from bottom of Biscayne Bay in grading golf course on Normandie Isle, Miami Beach, Fla. Athey tracks substituted for pneumatic tires on LaPlant-Choate 6-7-yd. scrapers drawn by Caterpillar diesel tractors enable scrapers to ride on top of sticky soil in moving total of 195,000 cu.yd. at rate of 1,056 yd. per unit per day, handling 8 yd. loose measure per trip and making twelve trips per hour on 900-ft. haul

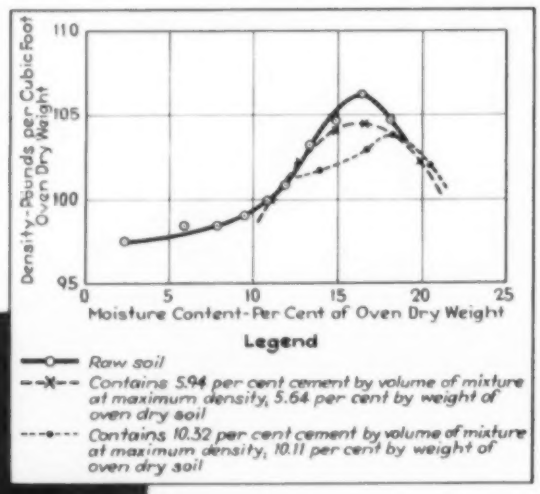
Experience in 26 States Develops Tested Procedure for Building

SOIL-CEMENT ROADS

By MILES D. CATTON

Development Department, Portland Cement Association, Chicago, Ill.

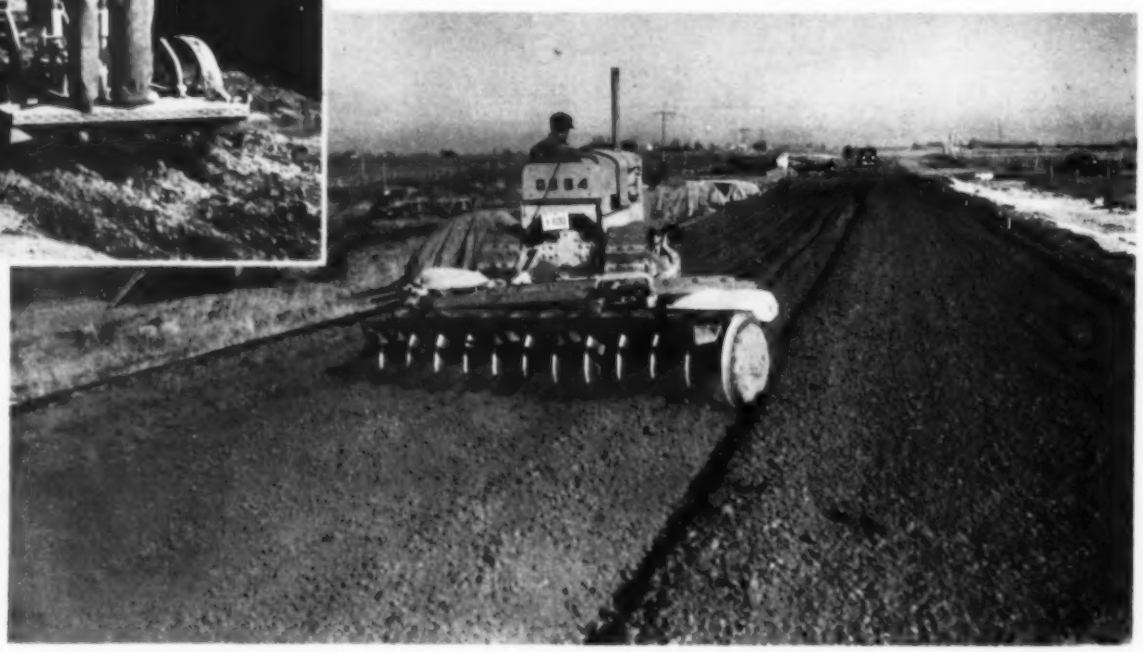
SOIL-CEMENT ROAD CONSTRUCTION completed or placed under contract totals more than 200 mi. in 26 states. About 100 mi. of soil-cement roads was built in 1938. Accompanying photographs illustrate construction practices which have been evolved on highway work and which represent a composite of successful and economical experiences and procedures.


Density-Pounds per Cubic Foot Oven Dry Weight
110
105
100
95
0
5
10
15
20
25
Moisture Content-Per Cent of Oven Dry Weight
Legend
Raw soil
Contains 5.94 per cent cement by volume of mixture at maximum density, 5.64 per cent by weight of oven dry soil
Contains 10.32 per cent cement by volume of mixture at maximum density, 10.11 per cent by weight of oven dry soil

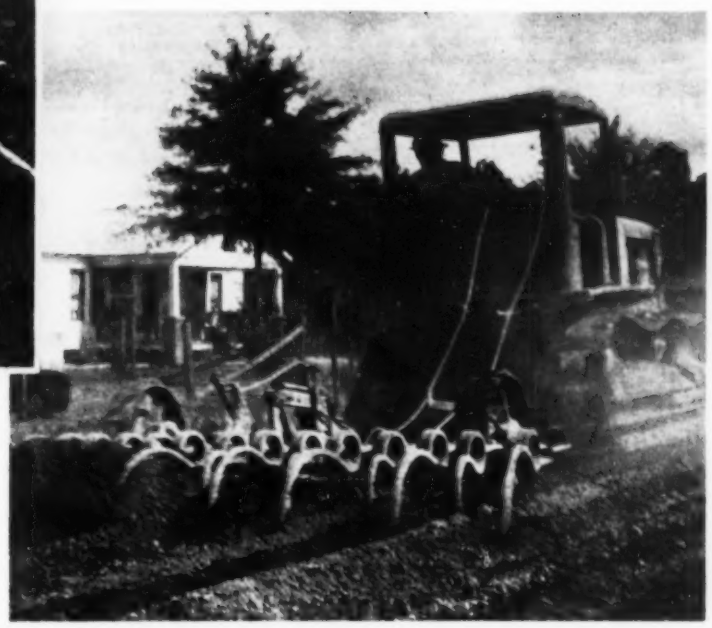
ROUTINE LABORATORY TESTS determine job control factors required for success. Tests set up cement contents to be used, as well as moisture contents needed to compact soil-cement mixture to required density. Curves show typical moisture-density relations of soil and soil-cement mixtures. Peak of curve gives moisture and density control factors. Similar tests are made as job progresses to control construction. Chart **(left)** gives moisture-density relations of raw soil and soil-cement mixtures compacted by standard Proctor method for Tippecanoe County, Ind., clay loam, U.S.B.P.R. soil group A-4.

(1) EXISTING ROADWAY is first bladed to required line and grade. It then is scarified to depth of about 5½ in. and to overall width extending 6 in. beyond each edge of soil-cement treatment.

(2) SCARIFIED ROADWAY (below) is pulverized by repeated trips of 24-in. offset disk harrows. Occasional trip with gang plows or field cultivators establishes bottom of 6-in. treatment and brings up bottom lumps for pulverizing. Offset disk harrows leave roadway smooth and even with little transverse or longitudinal displacement of soil. Note guide stakes on right shoulder controlling line and width of treatment.



3 **SACK CEMENT,** spotted in uniform longitudinal and transverse rows, is dumped for spreading by hand or by inverted spike-tooth harrow. Hand spotting and dumping are rapid and economical.



4 **SOIL AND CEMENT** are mixed by repeated trips of heavy-duty spring-tooth field cultivators equipped with depth control mechanism and power lift. Teeth are fitted with 4-in. or 5-in. shovels. Cultivators mix top two-thirds rapidly, and also mix in water after dry mix is completed. All mixing equipment makes successive clockwise and counter-clockwise trips to prevent excessive drag of material from section on either side.

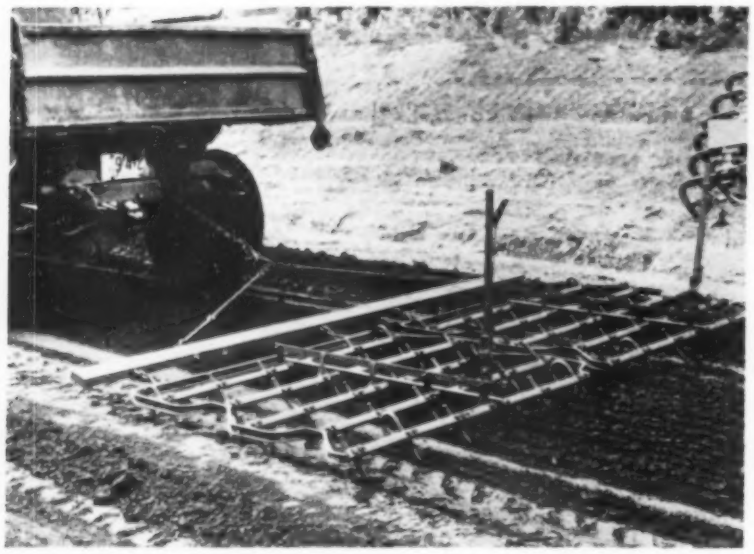
5 **WHEN DRY MIX** is about two-thirds completed, a three- or four-bottom gang plow, 14-in. moldboard, moves in on section, turns up bottom soil to permit rapid completion of dry mix with cultivators and establishes smooth subgrade at depth required to give completed, compacted section 6 in. deep. Plow comes in again later on damp mix to assist and control operations in same manner.

6 **REQUIRED WATER** is added in successive increments by pressure distributor. Field cultivator follows distributor on each trip to start damp mix and to prevent accumulation of moisture at surface. Later, gang plow moves in on section to bring up bottom material and control depth of treatment. Operations on damp mix are similar to dry-mix operations illustrated.

7 **WHEN SOIL-CEMENT MIXTURE (left)** is at required moisture content, section is loosened thoroughly with field cultivators and then is compacted with sheepsfoot rollers, from bottom up, to required density. Size of feet on rollers and unit pressures vary with soil types. A tamping foot of 6-sq. in. area mounted on drums which can be loaded to various unit pressures from 100 lb. to 300 lb. per square inch will successfully compact commonly occuring soils. Again note guide laths on shoulder which control width and line.

STEP-BY-STEP FIELD METHODS

(Continued)



9 **AFTER SECTION** has been compacted and shaped, it is essential to scratch out any surface compaction planes produced by sheepsfoot roller or grader. Spike-tooth harrow is used effectively and economically for this purpose. Experience has repeatedly demonstrated that any soil-cement packed on top of a smooth compaction plane will not knit down and will later peel or chip out. Therefore, critical inspection of surface finishing is required at this point in construction. Compaction planes are easily removed.

8 **TOWARD COMPLETION** of packing operations, blade grader moves in on section and, working with sheepsfoot rollers, shapes section to required crown and grade. This operation continues until only about ½in. to 1 in. of partially compacted mulch remains.

10 **FINAL COMPACTION** of surface is accomplished with tandem, smooth-wheel roller, working toward center from each edge. Roller knits surface down to required density. Soil-cement mixtures at required optimum are damp enough to knit down effectively without picking up on roller but are not so dry that they crack or shove while being rolled.

11 **IMMEDIATELY AFTER FINISHING,** surface is covered with damp earth, hay or straw, left in place 7 days. This damp cover prevents moisture evaporation from surface and permits roadway to harden at completed density. Failure to stop evaporation causes excessive surface crazing and cracking and materially reduces surface hardness.

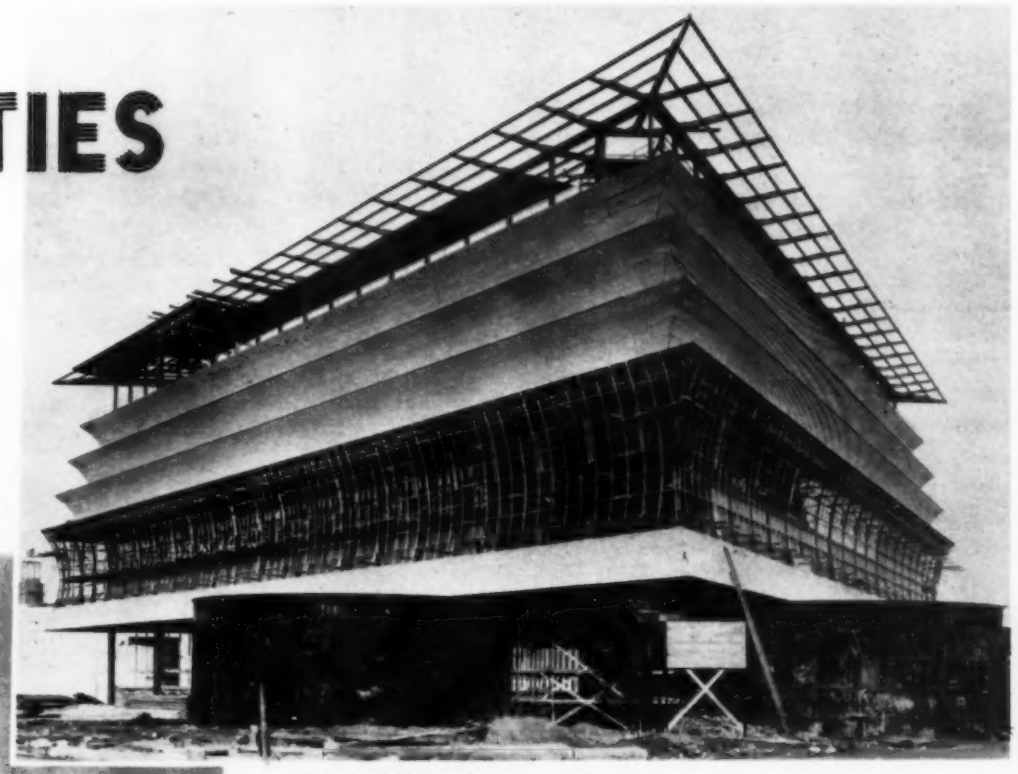
12 **COMPLETED SURFACE** is opened to traffic after 7 days' damp cover. Roadway should be used by traffic for a month or six weeks to develop any surface blemishes caused by inefficient surface finish. Survey of roadway conditions then will indicate whether thin bituminous cover is required to give a smooth riding surface. Should cover be required, roadway should first be carefully broomed and cleaned to expose hardened, closely knit soil-cement to which cover can be effectively bonded. Failure to remove loosened soil-cement will result in peeling and shoving of cover over such areas.

JOB ODDITIES

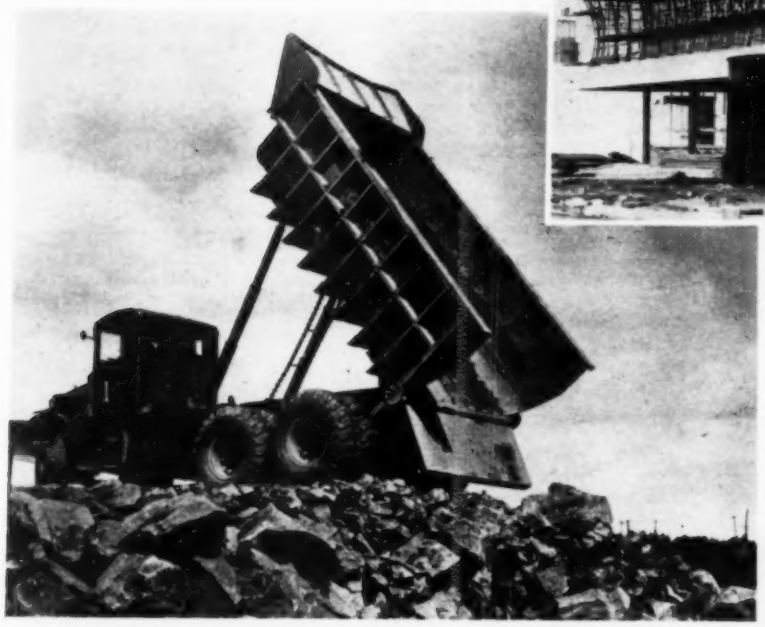
A MONTHLY PAGE OF

Unusual Features of

Construction



CORRUGATED IRON forms decorative exterior sheathing of Petroleum Industry building at New York World's Fair 1939. Sheets are applied with corrugations horizontal over gypsum wallboard in four flaring tiers of building and are painted in three tones of blue with petroleum base paints. Four reduced facsimiles of oil tanks (made up of riveted steel plates) partially support building, which is designed in shape of equilateral triangle measuring 200 ft. on each side.

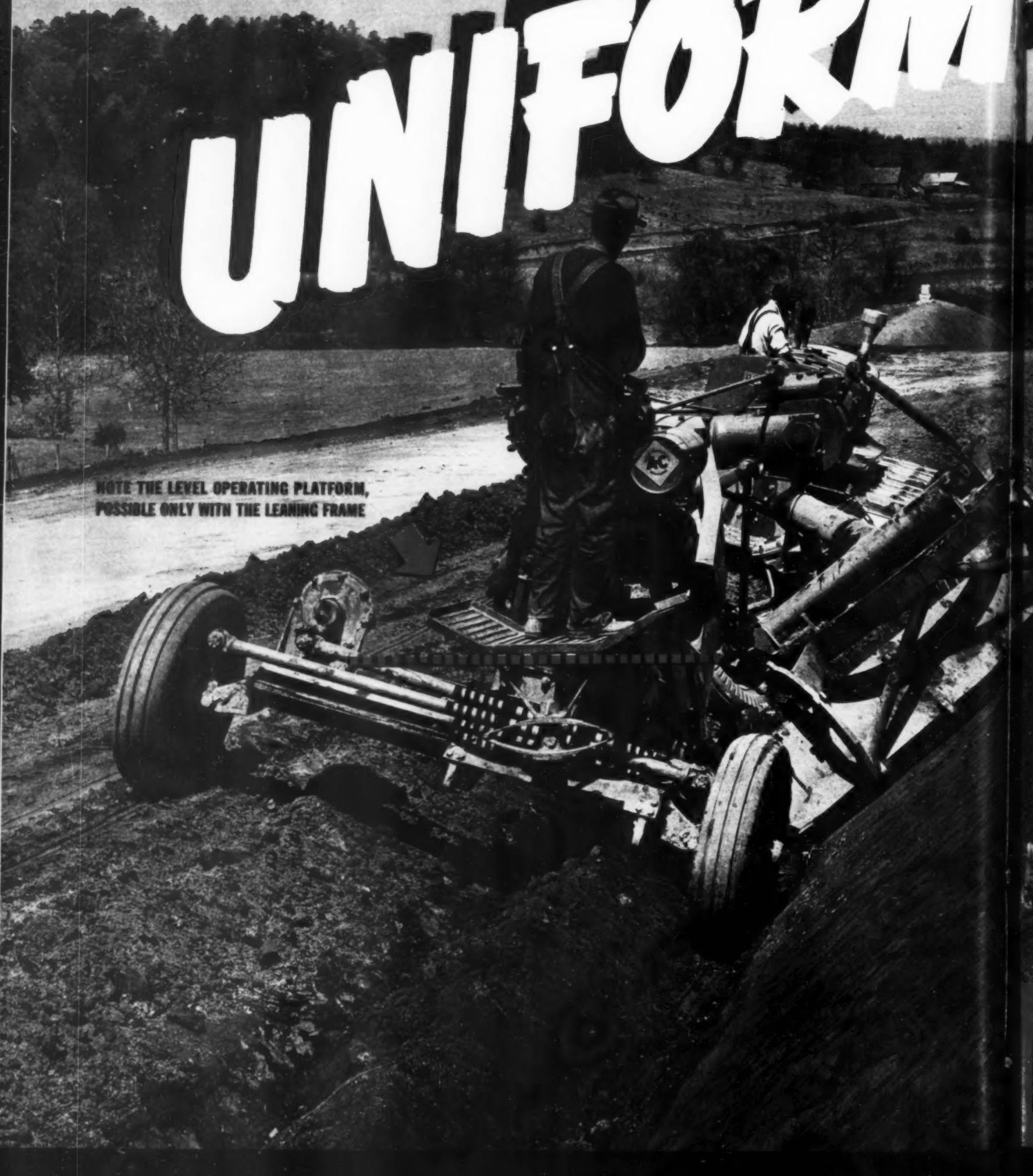


BIG BODY and steep dumping angle are features of this Mack truck, one of six similar units which International Nickel Co. is using for handling ore and building roads at its open pit mining operations in Frood, Canada. With a capacity of 35 tons, or 21 cu.yd., each truck weighs, loaded, 57 tons, has 10 speeds forward and 2 in reverse. Each truck is powered by diesel engine developing 150 b.h.p. at 1,800 r.p.m. Hydraulic body hoists provide dumping angle of 65 deg. Note heavy rib reinforcement of truck body to withstand impact of ore loads dropped by 4½-cu.yd. power shovels.

MINIATURE HYDRAULIC SCRAPER, duplicating its big brother in every detail, is one of operating models to be exhibited by Gar Wood Industries at convention and highway exhibit of American Road Builders Association in San Francisco, March 7 to 10. JACK B. HAILE, manager of Gar Wood's road machinery division, gives scaled-down replica his approval.

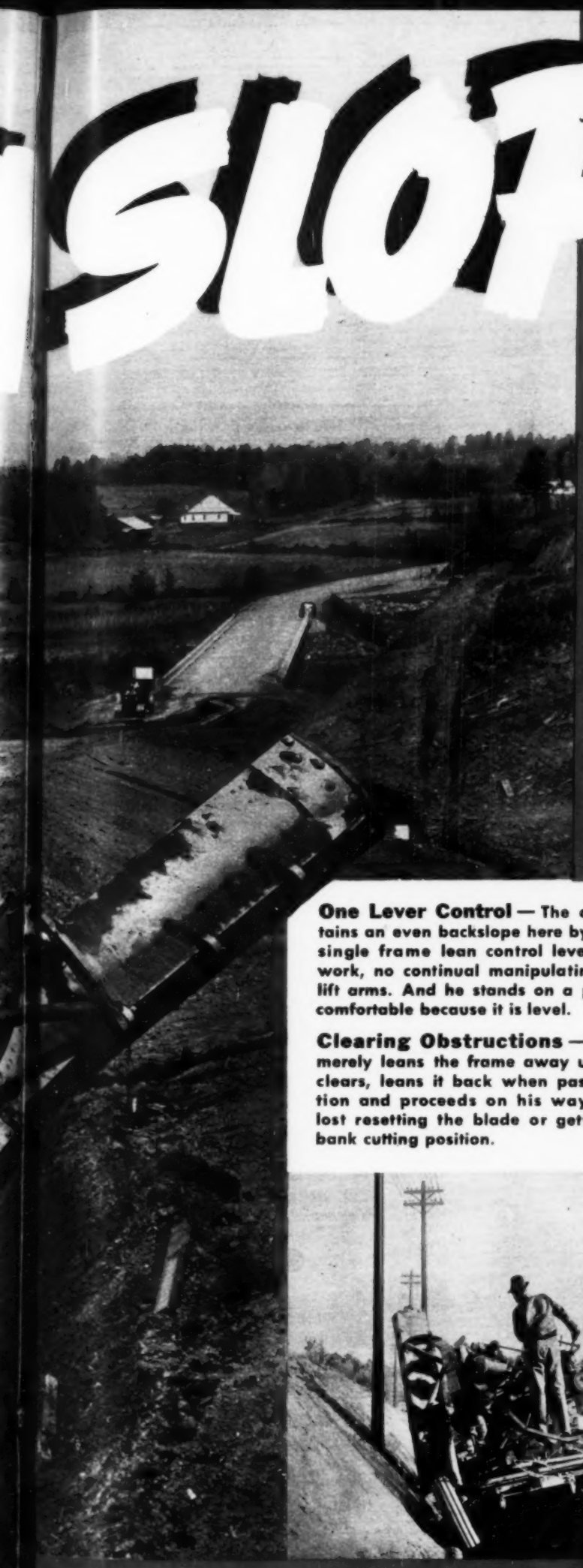
ROCK EXCAVATION (left) under careful direction of Sculptor Gutzon Borglum brings forth faces of **(left to right)** George Washington, Thomas Jefferson, Theodore Roosevelt and Abraham Lincoln on massive scale at Mt. Rushmore National Memorial, Rapid City, S. D. Note diminutive figures of two workmen on Washington's chest.

LEVEL THE PLATFORM.... FOR UNIFORM



NOTE THE LEVEL OPERATING PLATFORM,
POSSIBLE ONLY WITH THE LEANING FRAME

SLOPES!



One Lever Control — The operator maintains an even backslope here by means of the single frame lean control lever — no guesswork, no continual manipulating of crank or lift arms. And he stands on a platform that's comfortable because it is level.

Clearing Obstructions — The operator merely leans the frame away until the blade clears, leans it back when past the obstruction and proceeds on his way — no time is lost resetting the blade or getting back into bank cutting position.

BY USING THE FRAME LEAN CONTROL TO KEEP A LEVEL OPERATING PLATFORM YOU AUTOMATICALLY OBTAIN SMOOTH, EVEN DITCH AND BANK CUTS WITH THE *LEANING FRAME GRADER!*

Avoid humps and bows in ditch and bank slopes ... eliminate guesswork and constant grader resetting ... do a smooth job more quickly and in fewer rounds. It's easy when you use the Leaning Frame Grader. On starting into a cut you adjust the grader to the specified cross-section; from then on the only control needed is the leaning frame. Your gauge is the operating platform—when IT'S level you know you're cutting a uniform slope. When a wheel drops or raises, you simply level the platform by using the frame lean control — this automatically assures you a smooth, even cut. ONLY with the Leaning Frame Grader is this simple method of obtaining uniform slopes possible. Ask your Allis-Chalmers dealer to demonstrate the importance of the frame lean control — how it can be used to clear obstructions without readjusting the grader ... how it enables you to work on steep banks where other graders cannot even stick ... how you can use it to put extra pressure on the blade for heavy ditching or hard cutting. Try it on your job.

MADE IN TWO POWER-CONTROLLED SIZES — NO. 110 WITH 10 & 12-FOOT BLADES — NO. 112 WITH 12 & 14-FOOT BLADES.

ALLIS-CHALMERS POWER

TRACTOR DIVISION — MILWAUKEE, U.S.A.

TRACTORS, ENGINES, ROAD MACHINERY

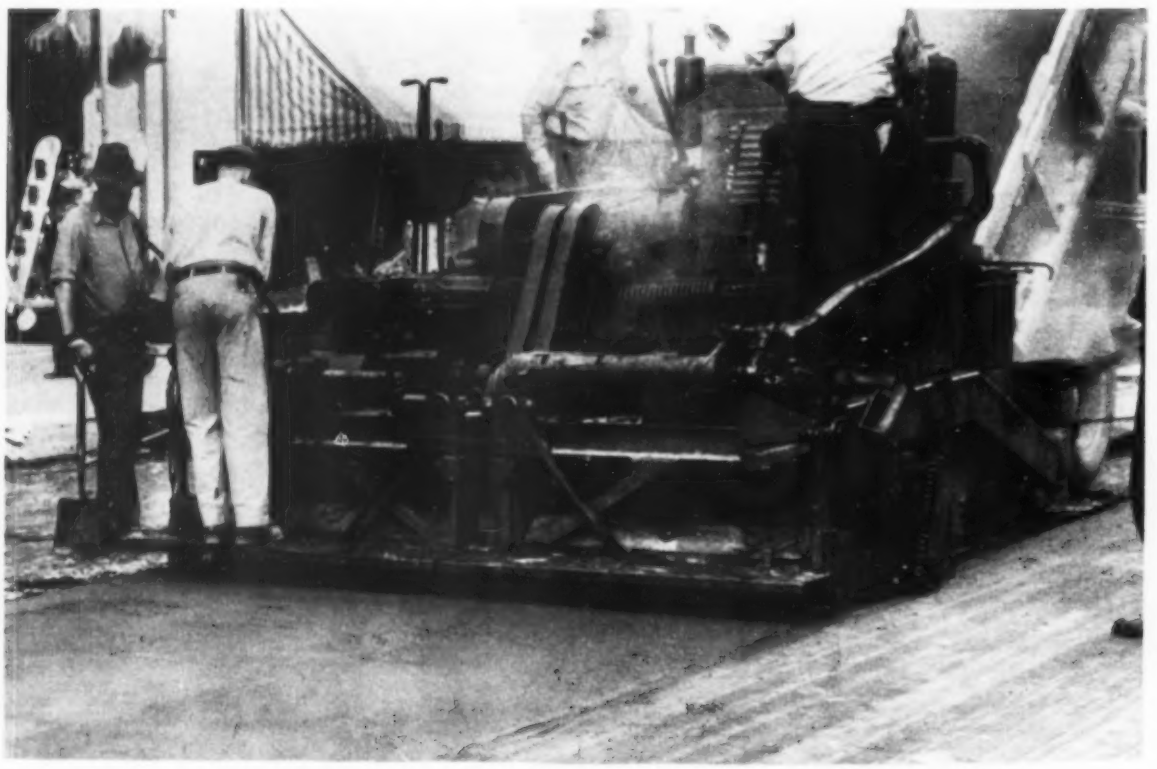
.. IT DOESN'T COST .. *it Pays!*

Self-Propelled Tamping Finisher

Lays 1-In. Sheet Asphalt Surface on Old Bituminous Pavement

LAYING THIN SHEET ASPHALT in 10-ft. lanes on top of old bituminous pavement, self-propelled finishing machine pushes dump truck forward while receiving load of hot material and placing it in dense surface mat. Machine finishes surface in smooth, level plane free from irregularities in longitudinal joints between adjacent lanes, where minor deviations are easily corrected by hand.

USING A SELF-PROPELLED TAMPING FINISHER equipped with a heated screed, the Geneva Construction Co., Aurora, Ill., last fall placed a 1-in. sheet-asphalt resurfacing course on nine blocks of streets in the central downtown area of Rockford, Ill., laying the new surface on top of old asphalt pavement in 10-ft. lanes and leaving a smooth, even finish in which joints are indistinguishable except for variation in color of adjacent lanes. Automatic leveling action of the finishing machine took care of old depressions, car tracks and manholes. The entire job, involving 775 tons of sheet asphalt placed in 16,000 sq. yd. of pavement, was completed with traffic detoured for not more than 48 hr. in any block and not more than 36 hr. at any intersection, in spite of the fact that primer had to be applied 24 hr. in advance of sheet asphalt.



SMOOTH, LEVEL JOINTS between adjacent lanes are finished to true plane by traveling spreader and finisher. Water marks from roller in stone dust on older lane create possible illusion of irregularity which is contrary to actual smooth condition.

Streets in the resurfaced area varied from 38 ft. to 44 ft. wide. All the existing asphalt pavement in the area was beginning to need repair. This condition, coupled with the fact that street car tracks on one street would have to be removed if pavement were to be rebuilt to existing grade, led the city to adopt the plan of leaving the tracks in place and resurfacing the entire area with a sheet asphalt top course 1 in. thick, compacted.

Resurfacing Operation—Old pavement was primed with ⅛ to ¼ gal. of RC1A at least 24 hr. ahead of the laying of the top course. The Geneva Construction Co. used a Barber-Greene tamping-leveling finisher for all the top course except small areas finished by hand between the curb line and property line at intersections. It was found that the machine could continue right through the intersection and on into the next block while this hand work was being done.

On streets more than 40 ft. wide, the finisher laid four adjacent 10-ft. strips, the curb strip in each case being laid with the outside end plate removed, allowing the spiral spreaders to bleed out the extra material needed. This portion, which was

CONTINUING ACROSS INTERSECTION. self-propelled finisher carries final lane on 44-ft. street from one block into next while asphalt crew behind machine uncovers manholes and spreads material in narrow curb strip. Roller operates on fresh lane in background. Contrasting sunlight and shadow on newer and older lanes, being broomed with stone dust by man at right, make it difficult to show smoothness of level surface.

spread by hand, was never more than 18 in. wide.

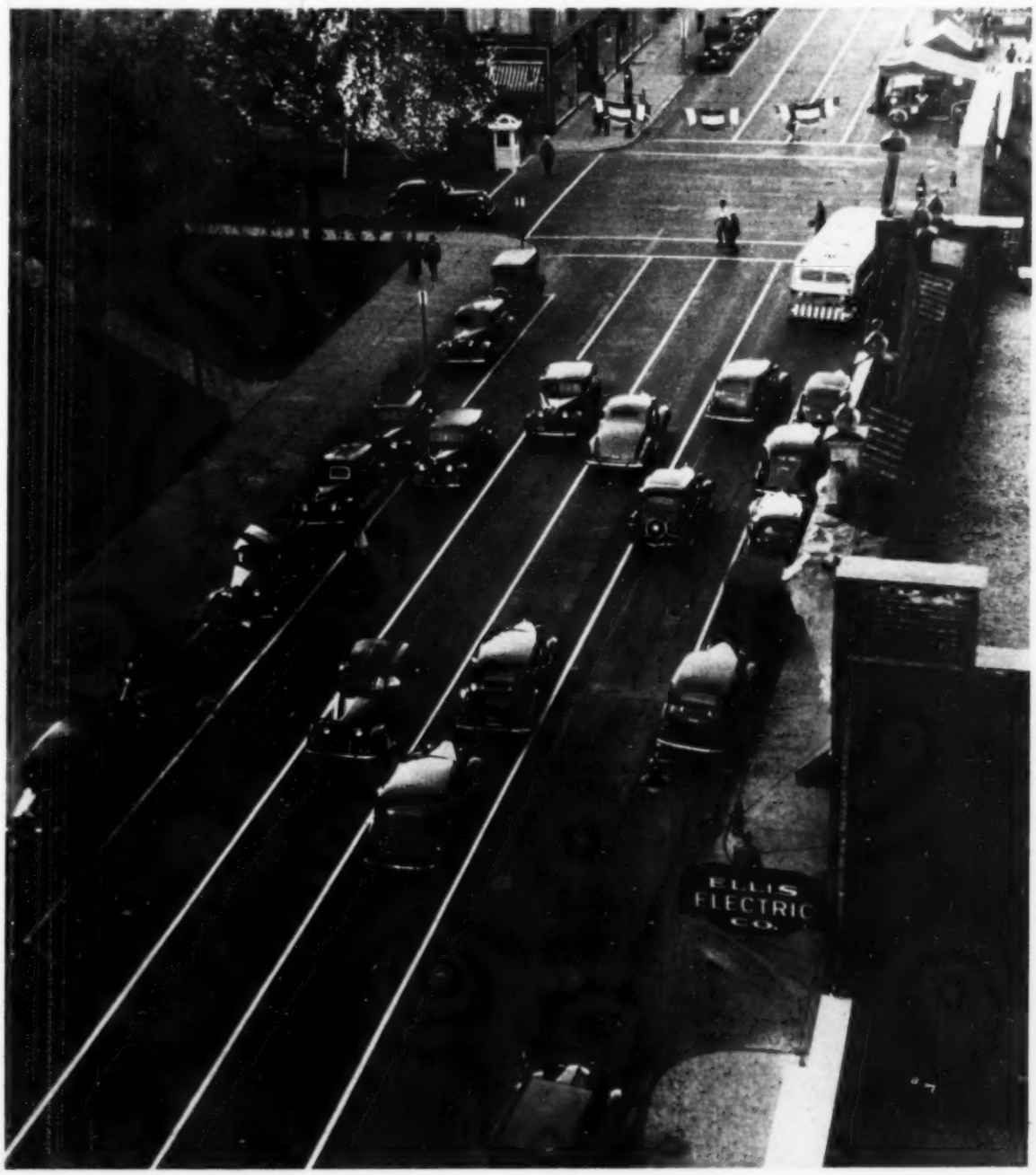
Asphalt Mixture — Material was furnished by the contractor from a central plant set up about 1½ mi. from the job, deliveries being made by three 5-ton trucks. The mix conformed with Illinois J1 sheet asphalt specifications and contained 12.8 per cent of Trinidad asphalt, fluxed to 50-60 penetration, and 14.2 per cent of 200-mesh mineral filler. Specifications required that material be delivered to the finisher at 300 to 350 deg. F., and tests showed that it was consistently delivered at above 300 deg.

Finishing Machine — In laying the sheet asphalt, the finisher operated throughout with a heated screed, in contrast with the usual practice on most bituminous jobs of heating the screed only when starting in the morning; while the machine is cold, and turning off the heat after the machine becomes hot. The finisher operated in low gear while laying, at a travel speed of 11 ft. per minute.

On this job, the finisher was equipped with an agitator originally designed to take care of lumpy or difficult material. The agitator consisted of a rotating studded shaft running the full width of the finisher just ahead of the vibrating tamper. This shaft tucked the material under the tamper; the tamping action, followed by the heated screed, obtained compaction while the mixture was in its most workable condition and produced a dense mat. As a result, cross rolling was practically eliminated.

Automatic leveling action of the finisher eliminated surface irregularities that existed in the old pavement. A 10-ft. straight-edge was used regularly as a routine check, but it was practically impossible to detect any

(Continued on page 90)



COMPLETED PAVEMENT receives prompt application of traffic stripes by Street Department, which follows one block behind finishing machine. During pavement construction, streets are closed for brief periods of not more than 48 hr. in any block and not more than 36 hr. at any intersection.

CONSTRUCTION STARTS with ground-breaking ceremony on first grading section, when WALTER A. JONES, chairman of Pennsylvania Turnpike Commission, turns shovelful of earth. Watching ceremony are (left to right): GEORGE H. KEITER, general superintendent, Harry T. Campbell Sons Co., Towson, Md.; L. M. HUTCHISON, contractor, Mt. Union, Pa.; R. B. STONE, chief construction engineer, Frank Bebout, member, and SAMUEL W. MARSHALL, chief engineer, Pennsylvania Turnpike Commission; G. DOUGLAS ANDREWS, PWA administrator for Pennsylvania.

Road Builders Start Grading of Pennsylvania's $60,000,000 Trans-Mountain Toll Highway

DIRECTING WORK for L. M. Hutchison on first turnpike construction contract is W. C. MOORE, superintendent of construction.

REALIZING A DREAM that has captivated the imagination of railroad builders and highway planners for generations, engineers and contractors of the Pennsylvania Turnpike Commission have started construction of a 161-mi. all-weather low-gradient express highway to be operated as a toll road between Harrisburg and Pittsburgh, utilizing for this $60,000,000 project partially completed grade and tunnels abandoned more than half a century ago after $10,000,000 had been spent on the projected South Penn R.R. Setting for itself the difficult task of completing the ambitious project, by far the largest of its kind ever undertaken in this country, in a total construction period of less than two years, the Turnpike Commission took a major stride toward its goal on Oct. 27, 1938, when it broke ground on the first grading section, awarded the previous day to L. M. Hutchison, Mt. Union, Pa.

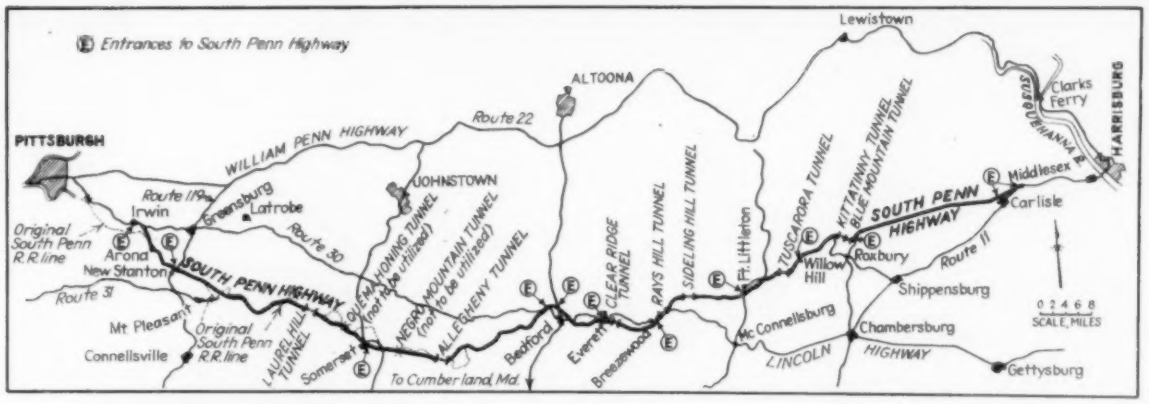
Bids for other sections were opened Nov. 29, Dec. 15, and Dec. 30, with awards to low bidders following promptly. Additional sections are being let at intervals of about 15 days, the lettings to continue through the spring and summer until the entire

BITING INTO SHALE behind 95-hp. diesel tractor, 12-yd. scraper fills bowl and carries average load of 8.7 pay yards to dump.

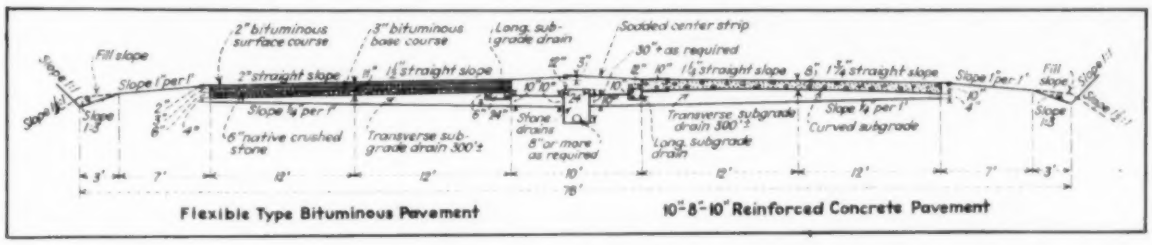
TRACTOR-DRAWN HYDRAULIC SCRAPERS move bulk of excavation on first contract section, digging and transporting shale on hauls up to 1,500 ft. Heavy rooter breaks up shale to facilitate scraper loading.

161 mi. of route, including tunnels, is under contract. It is estimated that 60 construction contracts will be required to complete the highway. To meet a PWA requirement, the project must be substantially completed by June, 1940.

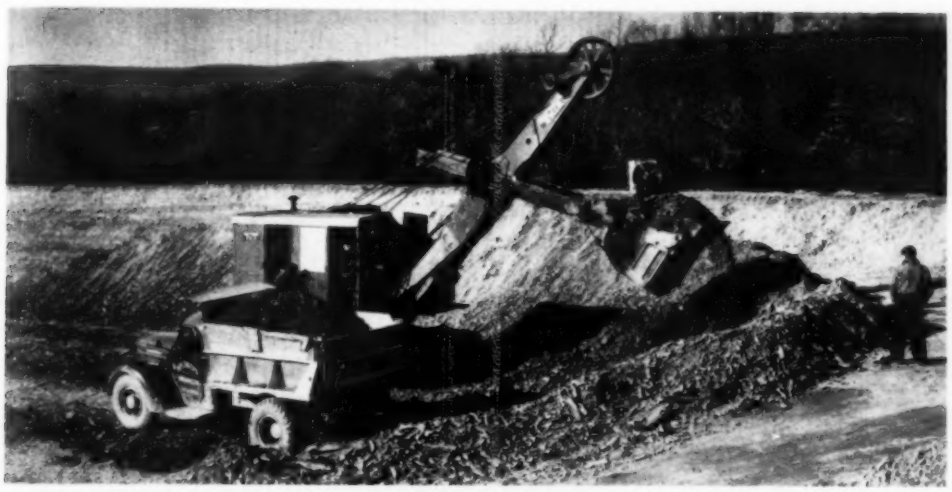
Toll Highway— Starting at a point on the Lincoln Highway 15 mi. east of the Pittsburgh city line, the new toll road crosses more than 100 mi. of difficult mountain terrain in the 161-mi. route distance to a connection with U. S. 11, 13 mi. west of the Harrisburg city line. The highway pierces eight ridges by means of tunnels to accomplish the mountain crossing with maximum grades of 3 per cent, as compared with common grades of 8 to 9 per cent on parallel east-west routes U. S. 30 and U. S. 22. The eight tunnels have an aggregate length of about 7 mi. and range in length from 1,110 to 6,662 ft. Seven of them are abandoned railroad tunnels, excavated to single-track or double-track width by the original builders for a total distance of 4¼ mi. An accompanying map indicates the route.



ALL-WEATHER EXPRESS HIGHWAY between Harrisburg and Pittsburgh in general follows location of abandoned South Penn R.R., partially constructed more than 50 years ago. New highway passes through seven of railroad's nine tunnels, eliminates remaining two, and adds one new bore (Clear Ridge) to achieve difficult mountain crossing with maximum grades of 3 per cent. Entrances will be provided at two terminals, Middlesex and Irwin, 161 mi. apart, and at other points as shown.



ROADWAY SECTION of 78-ft. overall width carries two 24-ft. roadways separated by 10-ft. planted strip. Entire highway is designed as limited freeway to accommodate trucks and high-speed traffic with safety and comfort. Flexible pavement will be used where subgrade settlement may be expected; either type may be used elsewhere.



THREE DIPPERS PER MINUTE (left) are loaded into trucks by 2-yd. diesel shovel. Shovel and truck outfits on first construction contract move excavation on hauls exceeding 1,500 ft.

Original location of the South Penn R. R. provided maximum grades of 2 per cent. By using a maximum permissible grade of 3 per cent, the turnpike engineers have shortened the distance and improved alignment. Between Harrisburg and Pittsburgh, the total cumulative climb by the new highway will be 3,940 ft. in comparison with a total cumulative climb of 13,880 ft. by the parallel Lincoln Highway route.

In general, the location follows the divide between the watersheds of the Susquehanna and Potomac Rivers, with a resultant small number of stream crossings. Right-of-way ordinarily is 200 ft. wide, except where additional land has been acquired to provide for highway facilities or for deep cuts and fills. Maximum depth of fill on the project is not expected to exceed 90 ft., and depth of cuts at the tunnel portals ranges from 40 to 60 ft. Grading quantities run as high as 300,000 cu.yd. per mile.

Throughout its length the turnpike embodies the most advanced features of design for a limited freeway, with grade separations at all railroad and highway crossings and with broad, divided roadways separated by a planted strip on the 154 mi. of route

MORE THAN FIFTY YEARS AGO, in 1887, contractors drive Rays Hill tunnel for South Penn R. R. with large crew of negro labor. Shorter man in foreground, with his left foot on crosstie, is believed to be Andrew Carnegie, who invested large sum in William H. Vanderbilt's railroad project in hope of getting new outlet from Pittsburgh steel mills to seaboard.

outside tunnels. Curves in general are held to a maximum of 4 deg., except in a few locations where topography requires the use of 6-deg. curves, of 955-ft. radius. All curves are spiraled and superelevated for 60 m.p.h., but the highway will have no speed limit.

Total Quantities — Construction of the highway involves some imposing quantities. Grading operations will require the excavation and placement in fills of 24,000,000 cu.yd. of earth and rock, while structures and roadway will take 475,000 cu.yd. of structural concrete, 4,300,000 sq.yd. of pavement and 45,000,000 lb. of reinforcing steel. Including partially excavated tunnels left by the railroad builders, the highway contractors will enlarge, drive and line 36,800 lin.ft. of tunnels. Direct employment on the job will amount to 21,000,000 man-hr. of labor, and an even greater volume of employment will be generated behind the lines in quarries, mills and factories supplying materials and equipment.

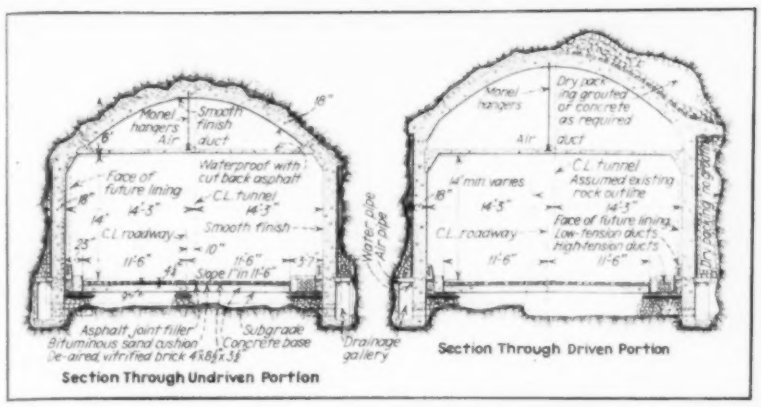
Construction Contracts—Contracts for grading, drainage and structures ordinarily cover about 10 mi. of route and have a value of about $500,000. An accompanying tabulation gives quantities and unit prices of the successful bidders on the first two contracts. The quantities on these two sections are roughly indicative of the volume of work to be performed on other typical grading contracts. Paving contracts will be awarded later.

Highway Design — Except in tunnels, where the roadway section reduces to two 11½-ft. traffic lanes, the highway carries throughout its length divided dual-lane roadways of 24-ft. width. The roadway section is graded 78 ft. wide, slope line to slope line on fills and ditch line to ditch line in cuts, with 10-ft. berms on the fills and 7-ft. berms in the cuts, as indicated by an accompanying cross-section sketch. Cut slopes are 1 on 1 and fill slopes 1 on 1½, except for special treatment of shallow cuts and fills. With few variations, the procedure in shallow cuts is to lay the slopes back to a minimum distance of 10 ft. from the ditch line. For fills up to 6 or 8 ft., slopes will be flattened to 1 on 4 to eliminate guard rails, except where topographical conditions prohibit this treatment. All slopes are rounded at the top.

At approaches to tunnel portals, the divided roadways converge into a single roadway which inside the tunnels has a width of 23 ft. between curbs, with a 2½-ft. walkway on one side. Tunnels will have a clear width of 28½ ft. between inside faces of the reinforced-concrete tunnel lining. Vertical clearance will be 14 ft., with ventilation ducts in the ceiling. Concrete lining will be 18 in. in thickness, necessitating tunnel excavation to a width of 31½ ft.

Contract Quantities and Prices First Construction Contracts, Pennsylvania Turnpike

ITEM	UNIT	FIRST CONTRACT L. M. Hutchinson, Mt. Union, Pa. QUANTITY	UNIT PRICE	AMOUNT	SECOND CONTRACT Girard Const. Co., Inc., Phila., Pa. QUANTITY	UNIT PRICE	AMOUNT
Clearing and grubbing	lump			$ 3,000.00			$ 15,000.00
Class 1 excavation	cu. yd.	831,256	.26	216,126.56	673,532	.29	195,324.28
Class 2 excavation	cu. yd.	13,909	1.25	17,386.25	12,865	1.25	16,081.25
Borrow excavation	cu. yd.	11,145	.27	3,009.15	118,145	.20	23,629.00
Reinf. cem. con. wear. surf., br. floors	sq. yd.	1,098	2.00	2,196.00	486	2.00	972.00
Class A concrete	cu. yd.	3,026	18.00	54,468.00	1,987	17.50	34,772.50
Class B concrete	cu. yd.	5,709	14.00	79,926.00	5,394	14.50	78,213.00
Plain steel bars	lb.	492,751	.04	19,710.04	501,988	.05	25,099.40
Plain structural steel	lb.	2,115	.10	211.50	13,882	.10	1,388.20
Stone backfill for structures	cu. yd.	264	2.00	528.00	152	3.00	456.00
Stone backfill for strings and unst. mat.	cu. yd.	2,355	1.50	3,532.50	2,212	2.00	4,424.00
Cement rubble masonry	cu. yd.	8	15.00	120.00	25	14.00	350.00
Dry rubble masonry	cu. yd.	2	12.00	24.00	9	12.00	108.00
Grouted stone slope wall	cu. yd.	16	15.00	240.00			
Type RS inlets	each	48	70.00	3,360.00	22	90.00	1,980.00
Type RS inlets without sump	each	17	100.00	1,700.00	3	50.00	150.00
Type E inlets	each				6	65.00	390.00
Cast-iron pipe, 18-in.	lin. ft.				246	3.75	922.50
Interlocking style cast-iron pipe, 18-in.	lin. ft.				178	3.75	667.50
Corrugated metal pipe, 15-in.	lin. ft.	208	2.00	416.00	213	2.25	479.25
Corrugated metal pipe, 18-in.	lin. ft.	184	2.15	395.60	36	2.50	90.00
Corrugated metal pipe, 24-in.	lin. ft.	478	3.00	1,434.00			
Corrugated metal pipe, 30-in.	lin. ft.				66	4.00	264.00
Corrugated metal pipe, 36-in.	lin. ft.				58	7.00	406.00
Corrugated metal pipe, 48-in.	lin. ft.				203	8.00	1,624.00
Asph. coated C.M.P., 42-in. 8-gage	lin. ft.	148	8.00	1,184.00			
Asph. coated C.M.P., 48-in., 8-gage	lin. ft.	142	10.00	1,420.00			
Asph. coated C.M.P., 54-in., 8-gage	lin. ft.	302	12.00	3,624.00			
Reinf. cement concrete pipe, 15-in.	lin. ft.				326	2.35	766.10
Reinf. cement concrete pipe, 18-in.	lin. ft.				1,932	3.00	5,796.00
Extra strength reinf. cem. con. pipe, 15-in.	lin. ft.	1,710	2.25	3,847.50			
Extra strength reinf. cem. con. pipe, 18-in.	lin. ft.	2,288	2.75	6,292.00			
Extra strength reinf. cem. con. pipe, 24-in.	lin. ft.	1,390	4.00	5,560.00	1,850	4.50	8,325.00
Extra strength reinf. cem. con. pipe, 30-in.	lin. ft.	490	6.00	2,940.00	598	7.00	4,186.00
Extra strength reinf. cem. con. pipe, 36-in.	lin. ft.	520	8.00	4,160.00	472	7.50	3,540.00
Extra strength reinf. cem. con. pipe, 42-in.	lin. ft.	116	10.00	1,160.00	92	10.00	920.00
Extra strength reinf. cem. con. pipe, 48-in.	lin. ft.	136	14.00	1,904.00	194	12.00	2,328.00
Extra strength reinf. cem. con. pipe, 54-in.	lin. ft.				136	13.00	1,768.00
Pl. cem. con.-vit. clay pipe, 15-in.	lin. ft.	4,032	1.40	5,644.80	1,246	1.50	1,869.00
Pl. cem. con.-vit. clay pipe, 18-in.	lin. ft.	2,096	1.75	3,668.00	738	3.00	2,214.00
Pl. cem. con.-vit. clay pipe, 24-in.	lin. ft.	442	3.00	1,326.00	274	3.50	959.00
Pl. cem. con.-vit. clay pipe, 30-in.	lin. ft.	10	5.00	50.00			
Corrugated metal pipe relaid, 15-in.	lin. ft.				10	1.50	15.00
Corrugated metal pipe relaid, 18-in.	lin. ft.	58	2.00	116.00	25	2.00	50.00
Corrugated metal pipe relaid, 24-in.	lin. ft.	12	2.50	30.00			
Corrugated metal pipe relaid, 30-in.	lin. ft.	13	3.00	39.00			
Corrugated metal pipe relaid, 48-in.	lin. ft.				40	6.00	240.00
Stone underdrain	lin. ft.	1,300	.60	780.00			
Perf. vit. clay tile underdrain, 6-in.	lin. ft.	1,000	.85	850.00	10,124	.50	5,062.00
Perf. vit. clay tile underdrain, 8-in.	lin. ft.	4,410	1.00	4,410.00			
Tile outlets, 6-in.	lin. ft.	50	.75	37.50	692	.40	276.80
Tile outlets, 8-in.	lin. ft.	220	.90	198.00			
Cr. aggr.-extra depth tile underdrain	cu. yd.	50	2.00	100.00			
Grouted rubble gutter	sq. yd.				215	3.00	645.00
Segmental grouted rubble spillway	cu. yd.	16	20.00	320.00			
Type 1-C guard fence	lin. ft.	864	.60	518.40	4,028	.65	2,618.20
Type 1-C end anchorages	each	8	12.00	96.00	26	15.00	390.00
TOTAL AMOUNT OF BID				$458,058.80			$444,758.98



TENTATIVE STUDY of tunnel design indicates principal dimensions and general treatment to be followed in driving (or enlarging), lining and paving eight tunnels on route.

SPECIAL CROSS-SECTIONING INSTRUMENT permits several successive tunnel sections to be taken from single instrument set-up. As made by W. & L. E. Gurley, instrument **(in inset)** consists of regulation wye level modified to permit rotation of telescope in wyes and equipped with graduated circle to measure position of rotation. Telescope is rotated each time reading is taken, and angular position is read on vertical circle, 4½ in. in diameter, attached to telescope near eye end and graduated in half degrees. Clamp over special bearing on telescope permits quick setting of telescope followed by fine setting with slow-motion tangent screw.

Six major bridges, ranging from 200 to 800 ft. in length and from 40 to 90 ft. in height, and 65 minor bridges will be required for stream crossings and grade separations. A number of the bridges will be reinforced-concrete rigid-frame structures.

Clover-leaf connections and necessary toll booths will be provided at a number of points along the route for entry and exit of traffic. At these locations the turnpike roadways will be widened by the addition of third lanes for acceleration and deceleration of arriving and departing vehicles.

General Character of Route—Starting at the western end of the turnpike, the highway traverses rolling country for the first 20 mi. at an elevation of about 1,000 ft. above sea level and, in the next 15 mi., climbs by 3 per cent grades to Laurel tunnel at El. 2,400. From this bore the route crosses two ridges on the mountain plateau to reach Allegheny tunnel at El. 2,350, in a distance of about 25 mi. Through this portion of the line, from the western terminus to Allegheny tunnel, the rock formation outside of tunnels consists principally of soft shales with interbedded sandstones which are not particularly hard. Between Somerset and Allegheny tunnel, the formation is varied by seams of coal and fire clay.

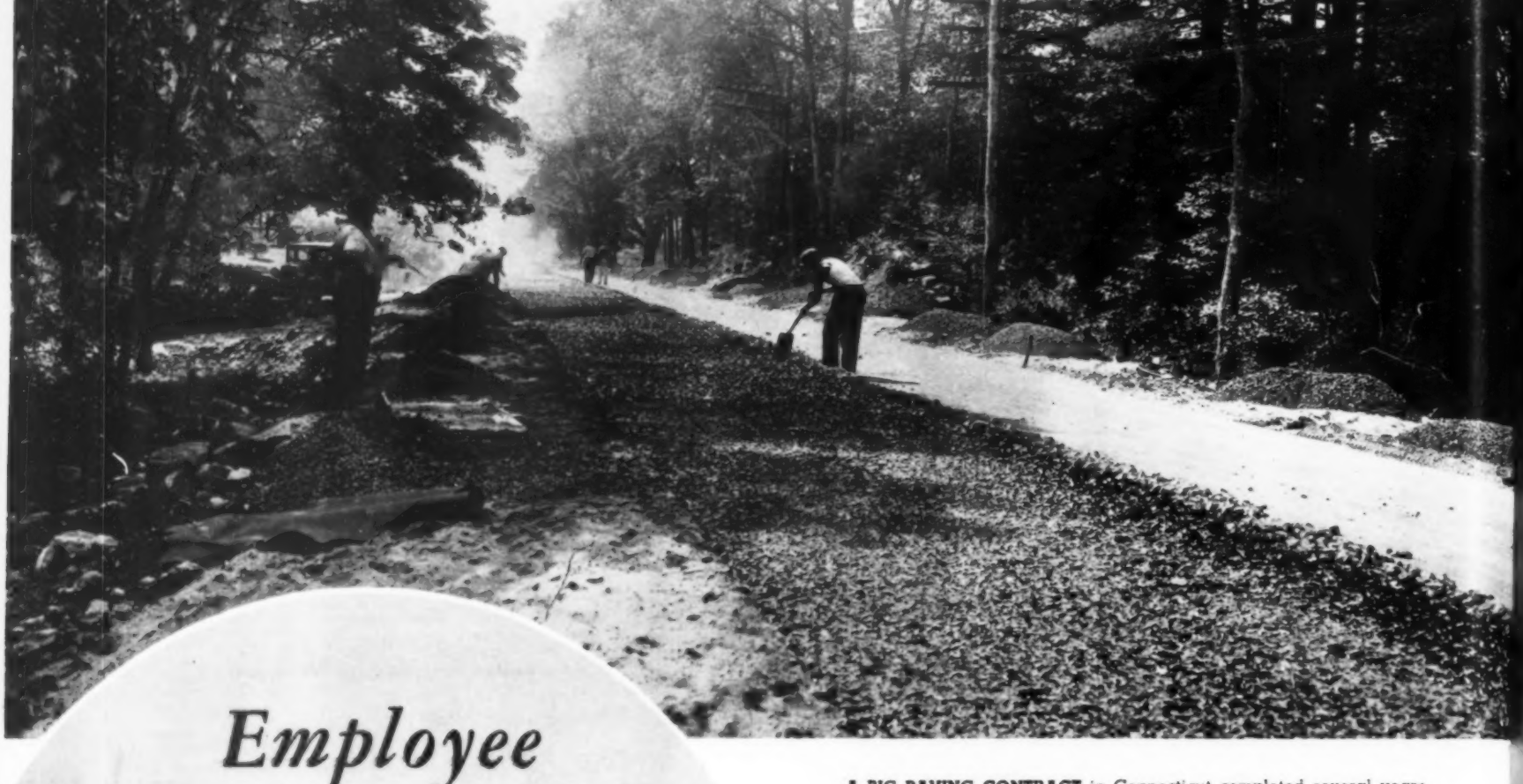
From Allegheny tunnel the route drops on 3 per cent grade and follows the Raystown branch of the Juniata River through the Bedford Narrows and Everett Narrows at El. 1,100 to El. 1,200. For 15 mi. east of Allegheny tunnel, the formation consists of interbedded shales and sandstones, not particularly hard, but in the 7 mi. west of Bedford the formation changes to a hard calcareous sandstone. At Bedford Narrows and Everett Narrows, the formation comprises quartzitic rock (very hard) and sandstone which is quartzitic in part. In a distance of about 10 mi. between the two narrows, the rock is mostly shale and limestone. Through the two narrows, the turnpike is in close proximity to the existing Lincoln Highway.

In 7 mi. of route between Clear Ridge tunnel and Rays Hill tunnel, the rock is red shale and sandstone. For a stretch of about 4 mi. from Rays Hill to Sideling Hill tunnel, the formation consists almost entirely of soft red and green shales. These two tunnels are at relatively low elevations, about 1,450 for Rays Hill and 1,300 for Sideling Hill.

In a stretch of about 17 mi. descending from Sideling Hill and crossing a valley at average El. 1,000 to Tuscarora tunnel, the rock ranges from soft shale to hard sandstone. Between Tuscarora tunnel, at El. 1,000, and the twin tunnels (Kittatinny and Blue Mountain) the route in a distance of about 10 mi. drops close to El. 800 before climbing to the latter tunnels at elevations less than 1,100 ft. In this valley, the formation consists of limestones and shales, with emphasis on the limestones. Adjacent portals of the twin tunnels are only 800 ft. apart.

(Continued on page 74)

PRELIMINARY CLEARING of old portal approach cuts, to permit draining and inspection of tunnels, precedes cross-sectioning of driven portions. George Vang, Inc., Pittsburgh, opens approaches and drains eight water-filled tunnels under $73,000 contract.



A BIG PAVING CONTRACT in Connecticut completed several years ago by the Lane Construction Corp. It involved 11½ mi. of bituminous macadam costing $500,000.

Employee Relations

IN THE ROAD BUILDING FIELD

Problems Affecting the Highway Contractor and the Men of His Organization Are Discussed by

THE LANE CONSTRUCTION CORP.

Meriden, Conn.

AMONG INDIVIDUALS composing the vast army engaged in highway construction, whether employers or employees, it is to be presumed that sentiment unanimously favors the existence of stable conditions in the industry which permit of the enjoyment of a sense of security equally by employee and employer. To treat separately the problems of the employer and of the employee is not logical. Conditions which favor the employer and which are adverse to the interests of the employee cannot long endure, because the employee bends every effort to finding more favorable work, with the result that the employer is faced by such a turnover in the personnel of his organization that efficiency suffers seriously and it becomes impossible for him to survive competition. Conversely, conditions favorable to the employee, and injurious to the employer, do not work for the good of the industry, because the employer becomes so insecure in his position that his ability to employ is jeopardized.

Loyalty Deserves Recognition

The employee should have reason to feel that his interests are the concern of his employer, that energy and ability on his part will result in his advancement, that he and his family are protected in the event of his injury or death in the line of duty, that his employment will be reasonably continuous and that facilities will be offered to him for presenting honest grievances. The employer is justified in expecting loyalty on the part of his employees.

Loyalty of employee and willingness on the part of employer to recognize, in a concrete manner, conspicuous ability and diligence among his employees constitute the foundations of what we have come to know as the American system of industry. It is a fact that these principles have not been adhered to universally in the highway construction industry, but without doubt the same may be said of any other industry. Road building has not occupied for long its present position among the major industries, and many of the conditions admittedly not ideal may be traced directly to the rapidity with which methods and equipment have changed in the rather hectic effort to keep pace with the demands of highway traffic.

If the solution of the problem of improvement in relations of employer and employee lies in the general adoption in its highest form of the American system — and we believe unreservedly that it does — our course at least is clear.

Steady work is the aim of the employee, and this is best accomplished by long, continuous service with a single employer although, of course, there are exceptions. Constant

changing of employers surely does not favor steady employment. Neither does a constantly changing personnel tend toward the development of that loyalty on the part of employees which is such a valuable asset to the employer. One of the major problems, therefore, is to reduce turnover in personnel.

The employer, if a highway contractor, is confronted by no little difficulty in keeping his entire organization busy at all times. There are periods during which he is unable to occupy the position of low bidder frequently enough to keep moving in high gear. It may be also that he is unfortunate in not taking contracts involving all of the types of construction which he is organized and equipped to engage in, with the result

"Constantly changing personnel prevents the development of that loyalty on the part of employees which is such a valuable asset to the employer."

that employees trained only in certain special pursuits find nothing to do in their respective lines. For instance, many highway contractors today would be hard put to it to keep their organizations working to advantage if fate were against them in being low bidders on concrete paving, regardless of the fact that they had adequate work of other types. So many of their employees would be trained only in various features of concrete paving

● One of the oldest and largest road-building organizations in New England, the Lane Construction Corp., of Meriden, Conn., whose views on contractor-employee relations are presented herewith, has been in business for a continuous period of 37 years, since it was founded in 1902. The firm has handled a large volume of highway construction in the New England states, New York and Pennsylvania.

that it would be very difficult to place them all at work which they could perform even passably well. Few concrete finishers, form setters and paving mixer operators would feel at home on a bituminous macadam job or a road-mix job.

Diversity in Duties

The training of employees in greater diversity of construction operations would tend toward more stability of organization in highway contracting. Both employer and employee have an interest in promoting this condition. To the employer it means less turnover in personnel and to the employee it means less lost time in looking for work with new employers. Today many of the larger highway contracts involve one or more types of pavement other than the predominating type for the job, for use perhaps upon shoulders or intersections. If it were seriously sought both by employer and emplyee, systematic training in the minor types would be possible upon these contracts for those whose experience has been confined to the predominating type of pavement. It is not to be expected, of course, that every employee may become proficient in all of the multitude of skilled pursuits incident to modern road building, but some diversity in training is possible, practicable and desirable.

There appears to be little hope of steady employment with a single organization for the employee in road building who does not care to move about. Few employers in the field of highway contracting are assured of obtaining contracts only in certain very limited fields in such total volumes as will keep their organizations busy. Furthermore, only a very limited number of employees skilled in any line can expect to find steady work in close proximity to their homes. The great majority of employees, therefore must move about from job to job. The life of a gypsy seems to be the fate of the average employee in the road building industry. Fortunately the automobile trailer, the overnight cabin and camps of various sorts have made the lot of the employee more endurable in isolated sections. Few highway contractors in the East today maintain living accommodations for employees, and it is doubtful if this custom, so prevalent in the early doys of road building, will return.

Living Conditions

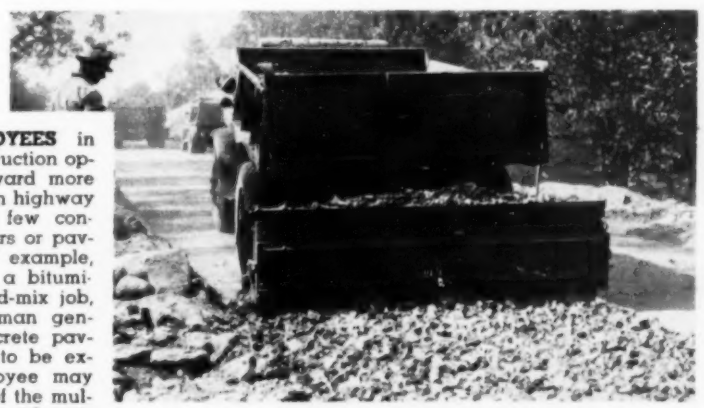
The employer has a responsibility which he should not shirk in assisting the employee in maintaining tolerable living conditions. The contractor's administrative force — superintendent, assistant, clerks, etc. — are first on the ground at the sites of new contracts. One of their first endeavors should be to investigate local living conditions and to assist employees, as

"The employer has a responsibility which he should not shirk in assisting the employee in maintaining tolerable living conditions."

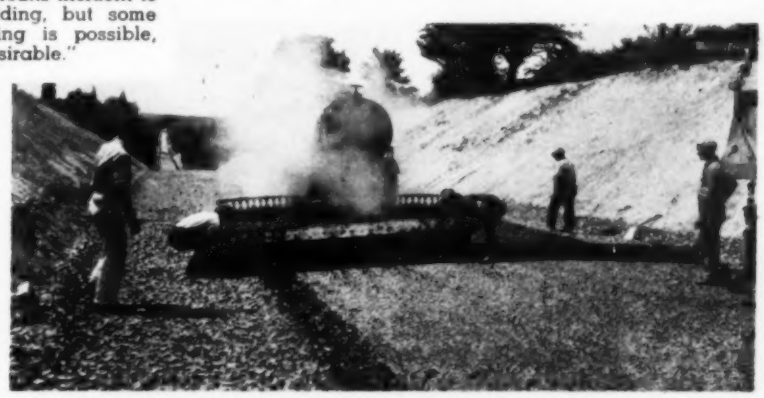
they arrive, in finding comfortable accommodations. Later it should be their duty to seek out conditions which are unhealthful, unwholesome or otherwise opposed to the welfare of employees. A man's home is his castle, but few resent sincere efforts to improve the general welfare.

The fact that the great majority of highway contracts today are subject to the stipulation that unskilled labor

(Continued on page 94)



"TRAINING OF EMPLOYEES in greater diversity of construction operations would tend toward more stability of organization in highway contracting. At present, few concrete finishers, form setters or paving mixer operators, for example, would feel at home on a bituminous macadam or a road-mix job, nor is the bituminous man generally familiar with concrete paving technique. It is not to be expected that every employee may become proficient in all of the multitude of skilled pursuits incident to modern road building, but some diversity in training is possible, practicable and desirable."



Old Pavement Salvaged in

Double-Tracking

Minnesota Main Route

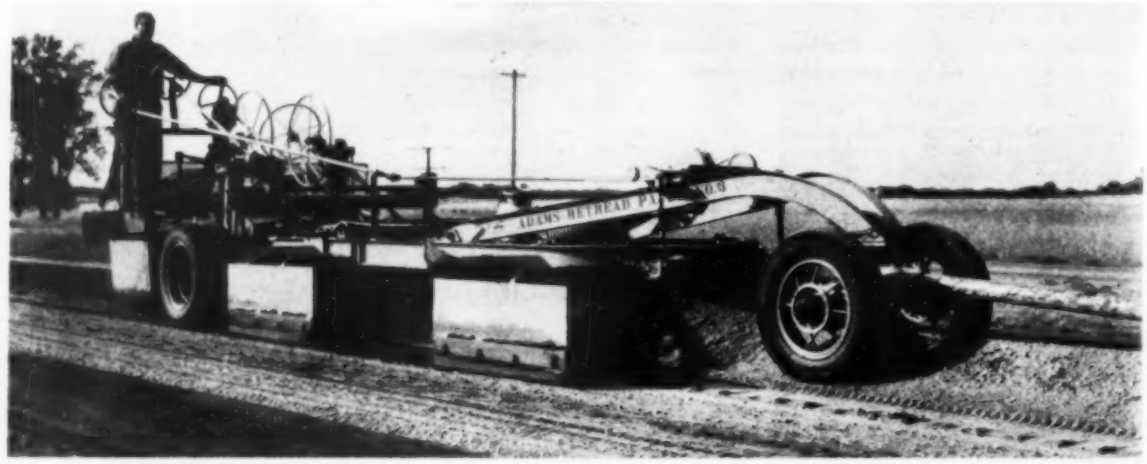
MOTOR PATROLS serve multiple uses in construction of new roadway: (1) blading subgrade stabilized with clay, (2) spreading two layers of stabilized base and (3) turning over material for each layer of road-mix tar wearing course.

ECONOMY in design and construction characterized a divided-lane highway improvement completed in the last few months between Elk River and Anoka, Minn., by McCree & Co. and Phillippi Bros., St. Paul, contractors, for the Minnesota Department of Highways. In a total length of 11½ mi. between these important highway junction centers, served until the present improvement by nothing more than an inadequate 18-ft. concrete pavement, the design and location engineers managed to salvage 9½ mi. of the old slab and incorporate it in the base of a widened and resurfaced 24-ft. roadway. Base widening and resurfacing made use of bituminous plant-mixed materials. A second 24-ft. parallel roadway was located on a right-of-way averaging 250 ft. wide at a center-to-center distance from the widened roadway of 97 ft. For this new construction, the design employed tar retread surface on stabilized clay-gravel base.

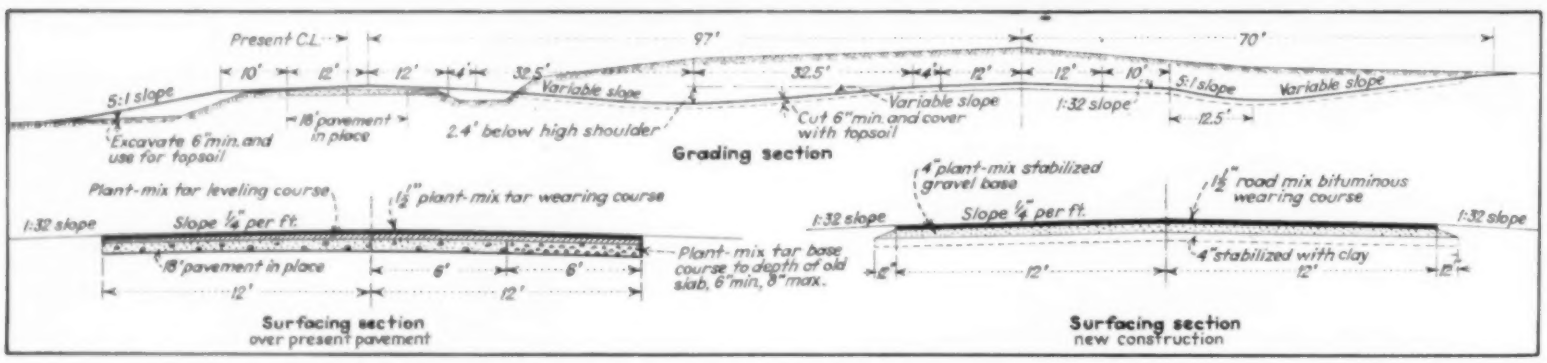
General Procedure — Specifications permitted minimum inconvenience to traffic during construction of the project. Grading and paving operations were planned by the contractor to facilitate uninterrupted flow of the heavy traffic using the road, which is the principal route west and north out of the Twin Cities. The construction force completed sections of new roadway and connected them by crossovers to the existing slab before closing any parts of the old pavement for widening and resurfacing.

In general, the new roadway lies to the south of the old road. This relation is varied only where improved alignment or general conditions made it advisable to shift the new roadway to the north side of the existing pavement. Relocation to improve alignment required the demolition and removal of about 2 mi. of old slab.

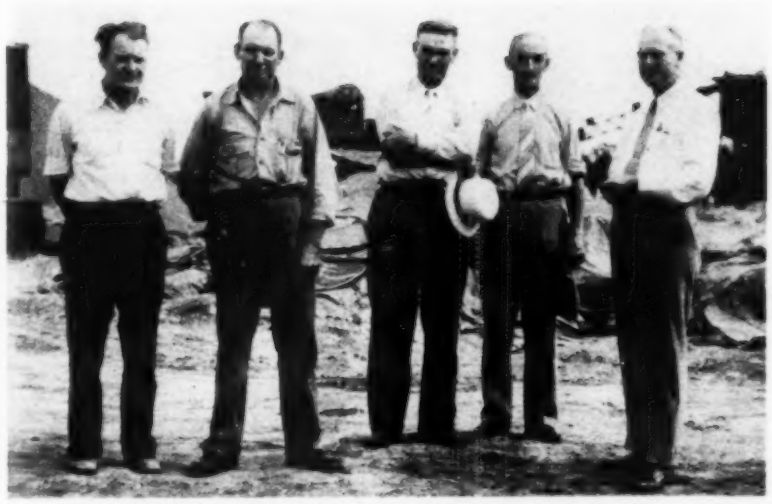
PRESSURE DISTRIBUTOR applies cold tar prime coat to stabilized gravel base after material has been compacted for minimum of 10 days under traffic.



RETREAD PAVER drawn by 60-hp. tractor mixes material for one layer of wearing course following application of cold tar and windrowing by motor patrols.

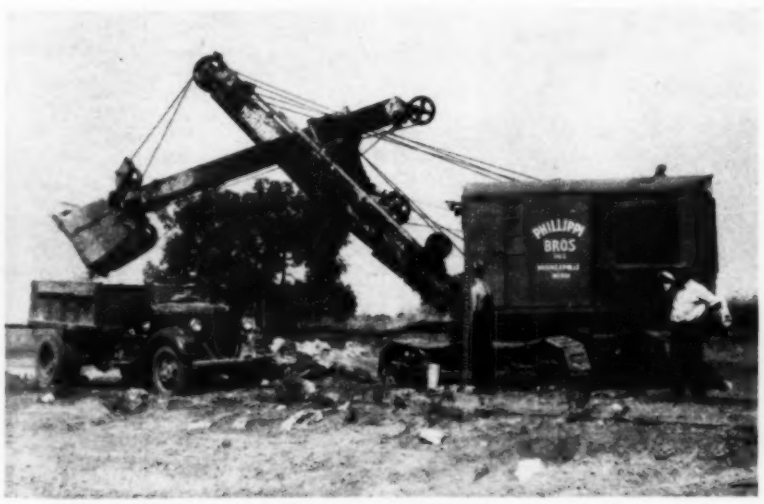


ON RIGHT-OF-WAY AVERAGING 250 FT. WIDE Minnesota builds divided-lane highway with roadways at center-to-center distance of 97 ft., salvaging existing slab to form part of base in one roadway and constructing second roadway of stabilized gravel base and tar retread surface.



IN CHARGE of construction (left to right): T. C. FAHEY, project engineer; BOB BRIELMAIER, superintendent; A. A. McCREE, president, McCree & Co.; GUY CHASE, secretary, McCree & Co.; and C. L. METHVEN assistant construction engineer, Minnesota Department of Highways.

BOTTOM-DUMP WAGON converted from crawler mounting to pneumatic-tired wheels receives 8-yd. load from 42-in. power-belt elevating grader.



DEMOLISHED SLAB is loaded into trucks by 1¼-yd. gasoline shovel. Alignment changes require removal of about 2 mi. of old road.

HYDRAULIC SCRAPER powered by separate engine mounted at rear of unit takes 8-in. cut in filling bowl with 12-yd. load.

Grading — Although the improvement traverses fairly flat country on the north side of the Mississippi River, generous treatment of the longitudinal and cross-section profiles in the design called for movement of about 500,000 cu. yd. of earth from cuts into fills. Cut slopes are laid back to within 5 ft. of right-of-way lines. Fills in general are shallow, with a maximum fill at the west (Elk River) end of the project having a height of 25 ft. Natural soil on the project ranges from sandy loam to medium sand. The material was placed in 6-in. layers in the fills as it came from the cuts and was compacted by sheepsfoot tamping rollers, except where the sandy soil did not contain enough natural binder to permit effective use of these rollers. In these places, traversing of fills by blades, tractors and hauling wagons proved a better method of compacting the sandy material.

All grading on the project was completed by the Phillippi Bros. division of the contracting firm, using modern excavators and earth-movers, as illustrated by accompanying photographs. Excavators included a Northwest 1¼ yd. gasoline shovel, an Austin-Western self-powered 12-yd. scraper, a LeTourneau 9-yd. carryall scraper, an Ateco 5-yd. scraper, and a Caterpillar 42-in. power-built elevating grader. For hauling, the grading crew had six Euclid 7-8-yd. wagons, originally mounted on crawler tracks but recently altered to pneumatic-tired two-wheel carts. These wagons operated two or three in tandem behind a tractor. The tractor fleet comprised one Allis-Chalmers LO, one Caterpillar RD8, four Caterpillar RD7, and two Caterpillar gasoline units, a 60-hp. and a 30-hp. An Austin-Western four-wheel dual-drive motor patrol blade spread material on the dump, leveled roadway shoulders and trimmed slopes.

New Roadway Construction — McCree & Co. took care of all roadway construction, pavement widening and resurfacing. In starting construction of the second parallel roadway, the contractor first stabilized the base by adding clay to the sandy soil, much of which contained practically no binder. As indicated by the accompanying cross-section sketch, the design called for a 4-in. depth of subgrade stabilized with clay. Pulverized clay was added to the sandy subgrade at the maximum rate of 6½ tons per station and was worked in with spring-tooth harrows and tandem disks. After thorough mixing, the subgrade was bladed to shape, sprinkled by a tank truck and rolled with a pneumatic-tired roller.

On top of the stabilized subgrade is a 4-in. layer of plant-mixed stabilized gravel base placed in two 2-in. courses. Material for the two courses was produced by a Pioneer stabilizing plant which operated on this job at a capacity of about 100 tons per hour. The two courses used duplicate mixtures of crushed gravel, fine sand and clay, with the exception that to the mixture for the top 2 in. was added 9½ lb. per ton of calcium chloride.

Proportions by weight of the two mixtures averaged about 75 per cent gravel, 10 per cent fine sand, and 15 per cent clay. It was necessary to add the 10 per cent of fine sand because the gravel was deficient in fines. For both layers, 7 to 8 per cent by weight of water was added at the mixer.

Each layer was spread with power patrol blades and was rolled with a pneumatic-tired roller. The method of handling traffic over stabilized gravel base varied in the early and later stages of the work. During the first part of the job, the contractor waited until the second layer had dried sufficiently — in a minimum of 24 hr. or more — and then applied a prime coat of 0.25 gal. per square yard of cold tar TC 1. Traffic was turned into the road 24 hr. later and was permitted to use it for 3 to 5 days before the road-mix crew started

the first layer of tar retread surface.

Later this practice was discontinued. The heavy traffic caused serious abrasion, especially at weak spots, of the stabilized gravel mat, with resulting difficulty in maintenance. Procedure was changed to postpone priming the stabilized gravel base until traffic had used it a minimum of 10 days, which gave better compaction. During the period of traffic use, the roadbuilders maintained the stabilized gravel mat in good shape by occasional sprinkling and by blading with motor patrols. Sprinkling with water proved effective to a great extent in preventing abrasion and resultant segregation of materials. Prime coat was applied after traffic had been taken off the road, and surfacing operations then proceeded in the regular manner.

Mix-in-Place Surface — Tar retread surface was placed in two layers, 80 lb. per square yard in the first layer, and 100 lb. in the second. After placing crushed gravel for the first layer in a windrow on the road, the contractor spread the material with motor patrols and shot it with 0.55 gal. per square yard of cold tar, TC5. The material again was windrowed by the patrols and was mixed four to six times with an Adams retread paver, followed on each pass by a patrol blade and broom. Following each mixing with the retread unit, the patrols continued to turn the mixture over until the materials were thoroughly and homogeneously combined. The mixture then was spread and rolled with two steel flat rollers, a 6-ton roller for the first rolling and a 10-ton roller for the final rolling.

After setting for about 4 days, the first layer was ready for application of the second layer. Mineral aggregate to the amount of 100 lb. per square yard was windrowed on the road and was shot with 0.67 gal. of cold tar, TC5, in two applications, being mixed in the same way as the first layer after each of the two applications. Following final spreading and rolling, the completed layer was allowed to stand for 4 to 7 days, depending upon the weather, before the contractor applied a cold-tar seal of 0.15 gal. TC5 per square yard, with no aggregate. The seal application penetrated rapidly, and 24 hr. later the roadway was ready to be opened permanently to traffic.

Motor patrol blade machines played an important part in the three stages of construction: (1) stabilized subgrade, (2) stabilized gravel base, and (3) tar retread surface. The contractor operated three power control units, Adams, Austin-Western and Wehr.

Widening and Resurfacing—Alongside the salvaged slab, the construction crew excavated a trench 6 ft. wide and filled it with plant-mix tar-limestone concrete, building up the 6-ft. extension of the base in four courses at the rate of about 200 lb. per square yard in each course. The mixture contained 5 to 6 per cent by weight of tar cement and 94 to 95 per cent by weight of mineral aggregate.

Over the entire 24-ft. width of widened base, the contractor spread a leveling course of plant-mixed trap rock and tar at an average rate of 200 lb. per square yard, followed by a wearing course of the same mixture applied at 150 lb. per square yard. The mixture for these two courses contained 6 to 7 per cent by weight of tar cement and 93 to 94 per cent by weight of aggregate. Before placing the leveling course, the contractor primed the base with cold tar TC1 and, after completion of the wearing course, sealed the surface with cold tar TC5.

In places where the old slab was removed, the design called for a stabilized gravel plant-mix base course on stabilized subgrade, duplicating the treatment of the south lane. On the stabilized gravel base went a leveling course and wearing course of the same mixture placed on the old pavement base. All plant-mix tar concrete on the project was placed by Adnun and Jaeger self-propelled spreader-finishers.

TAR CONCRETE for widening and resurfacing old pavement is produced by mixing plant equipped with 4,000-lb. pugmill.

Partial List of Contract Quantities and Prices

MINNESOTA STATE HIGHWAY CONTRACT, ELK RIVER TO ANOKA

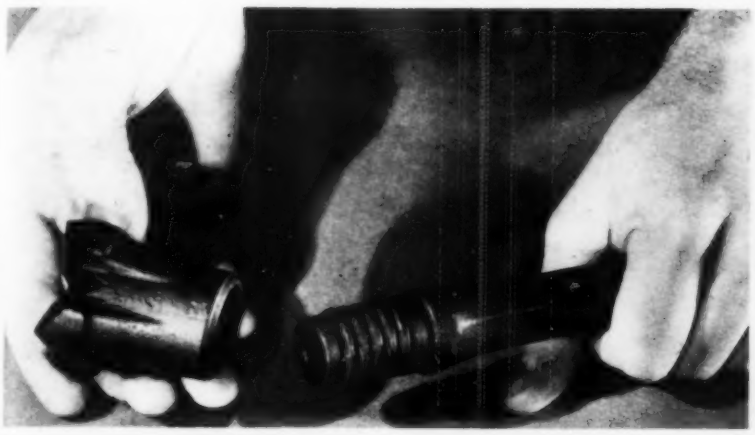
McCREE & CO. AND PHILLIPPI BROS., ST. PAUL, MINN., CONTRACTORS

Item	Unit	Estimated Quantity	Unit Price	Amount
Excavation, earth	cu. yd.	507,756	$0.14	$ 71,085.84
Excavation, overhaul	cu. yd.-sta.	1,538,950	0.005	7,694.75
Borrow excavation	cu. yd.	61,722	0.10	6,172.20
Hauling borrow excavation	cu. yd.-mi.	48,215	0.18	8,678.70
Hand ditching	cu. yd.	2,064	0.50	2,367.50
Remove concrete pavement	sq. yd.	23,675	0.10	2,367.50
Subtotal "A" of above items plus clearing, grubbing, culverts, handwalls, drop inlets, manholes, concrete curb, etc.				$130,166.99
Stripping binder soil deposit	cu. yd.	1,500	$0.35	$ 525.00
Load binder soil	ton	5,231	0.50	2,615.50
Haul binder soil	ton-mi.	31,209	0.20	6,241.80
Binder soil material	ton	5,231	0.10	523.10
Stabilization of subgrade	sq. yd.	229,974	0.05	11,498.70
Water applied on road	M-gal.	575	4.00	2,300.00
Stabilized gravel base course-in place	ton	48,863	1.45	70,851.35
Subtotal "B"				$ 94,555.45
Bituminous plant mix, base course-in place	ton	14,280	$3.50	$ 49,980.00
Bituminous plant mix, leveling course -in place	ton	17,501	4.45	77,879.45
Bituminous plant mix, binder course-in place	ton	10,072	4.45	44,820.40
Bituminous material for prime coat, mixed-in prime course, wearing course and seal coat—delivered on road	gal.	334,274	0.105	35,098.77
Windrowing gravel, mixing, shaping and rolling	sq. yd.	180,364	0.05	9,018.20
Mineral aggregate for mixed-in prime course and wearing course	ton	16,232	0.90	14,608.80
Subtotal "C"				$231,405.62
Grand total for entire contract				$456,128.06

Two Mixing Plants—Mixing plants for stabilized clay-gravel and for bituminous concrete were set up near the center of the project at a siding where stone and tar could be delivered by rail. A Pioneer clay stabilizer plant produced clay-gravel mixture at a rate of 100 tons an hour. Tar concrete was mixed by a Madsen plant with a capacity of 2,000 tons per day. This plant was equipped with an 8x30-ft. dryer, vibrating screens and a 4,000-lb. pugmill.

Direction — For the Minnesota Department of Highways, N. W. Elsberg is commissioner of highways, J. T. Ellison is assistant commissioner and chief engineer, O. L. Kipp is construction engineer, and C. L. Methven is assistant construction engineer. Operations on the Anoka-Elk River improvement were directed for the department by T. C. Fahey, project engineer.

Paving work on the job was executed by McCree & Co. of the contracting concern, McCree & Co. and Phillippi Bros., St. Paul, under the general supervision of A. A. McCree and the personal direction of Bob Brielmaier, superintendent. S. J. Phillippi, of Phillippi Bros., was in charge of grading operations.



Detachable Bits

Favored by Construction Men, Survey Shows

A MARKED TREND toward increased use of detachable bits instead of forged drill steel for drilling operations in the construction industry is indicated by results of a survey recently made by the market research department of CONSTRUCTION *Methods and Equipment* to cover a representative group of contractors and federal and state engineers in charge of construction. The results reveal that in the United States 89 per cent of the contractors and engineers canvassed use detachable bits either exclusively or to a considerable extent on their drilling work. Of those drilling with both detachable bits and forged drill steel, 78 per cent report an increasing use of detachable bits. Exclusive use of detachable bits is reported by 62 per cent of the construction men who supplied information about their drilling practice.

Relative Merits—Convenience is the predominating reason given by construction men for using detachable bits. Next in order are economy, uniformity of quality in temper and gage, time-saving, adaptability to small jobs through eliminating need of blacksmith, and "size range."

The chief objections to detachable bits are "wear or breakage of rods or threads" and "cost." Other unfavorable features of detachable bits were reported to be: "Different makes not interchangeable;" and "temper cannot be varied when rocks differ." Some construction men state that sharpening reduces the gage of detachable bits and that bits are not always obtainable from supply houses near construction jobs.

Regrinding—Detachable bits are used once and thrown away by 24 per cent of the construction men reporting domestic practice. Thirty-six per cent of users do their own regrinding of bits while an equal percentage depend upon outside grinding services. The number of regrindings as reported is: None, 24 per cent; one, 3 per cent; two, 28 per cent; three, 18 per cent; four, 4 per cent; five or more, 2 per cent; variable, 1 per cent. The remaining percentage of construction men made no report on their regrinding experience.

Drilling Costs—Comparative costs of drilling with detachable bits are kept by only 24 per cent of the construction men who reported. Of this number 70 per cent report drilling to be cheaper with detachable bits; 10 per cent say that it is cheaper on small jobs but costlier on large ones; 10 per cent find that costs vary according to character of work; while 5 per cent indicate that bit drilling is more expensive than drilling with forged steel.

General Comments—Among the comments made by construction men regarding the use of detachable bits for drilling, are the following:

Favorable

More footage per bit; eliminates loss of steel.

More economical; no necessity for carrying large stock of drill steel.

Ease and low cost of transportation on the day's supply of steel.

Uniform hardness and temper of all bits.

Less steel to carry; more footage per drill.

Very good for small jobs where you cannot afford a blacksmith.

Easy to replace; no waiting for resharpening.

DETACHABLE BITS and grinder for sharpening.

With fewer nippers on job, drillers are able to have constant supply of sharp steel; makes them more efficient.

Originally switched to detachable bits because of the difficulty of finding capable sharpening service for drill steel.

Convenience of transportation and accuracy of gage; greater percentage of recovery of stuck steel.

Can use an assortment of bit sizes with one rod.

Drill shaft is always the same length, not getting shorter by resharpening. You can make a quick change to a sharp bit and have less weight to carry to the grinding shop.

Bit drilling is cheaper largely because fewer bits are stuck in hole.

On two 20,000 yd. rock jobs—detachable bits shows 23 per cent savings; less breakage accounts in part for this.

Saves handling to and from stock or yard. Easy to handle.

Ease of nipping; larger supply of cutting edges; portability; uniformity of cutting edges, gage and temper.

Unfavorable

Drill rods wear out quickly, break at shank.

All makes should be standardized and interchangeable.

The bits cost too d—— much.

Thread breakage—shank breakage.

Inability to interchange different makes of bits.

Thread fracture in some instances.

Dislike the diminishing of their diameters due to wear.

They don't seem to stand up well in drilling hard boulders or igneous rock.

Dislike difficulty in obtaining shanks to stand strain; they must be heat-treated.

Conclusion—The survey reveals that detachable bits have a strong foothold in the construction industry and that their popularity is increasing. There is, however, room for improvement in design of shanks and threads or in quality of rod steel. There is need for wider and more precise knowledge of cost performance in this field.

Almost one-quarter of users do not regrind bits. About 28 per cent get two regrindings and 18 per cent three regrindings.

Two makes of detachable drill bit out of a total of six enjoy a strong preference in the construction field, the leader receiving a 54 per cent recognition and the runner-up a 34-per cent recognition.

BROAD BELT CONVEYOR attached to rear of traveling mixer stacks stabilized material in heavy windrow averaging 55 tons per station.

REAR-END BELT ATTACHMENT

Enables Pugmill Travel Plant To Mix Heavy Windrows

A REAR-END BELT CONVEYOR attachment designed to relieve the load on the triple pugmill mixing unit of a Jaeger mix-in-place travel plant by carrying away the mixed material and depositing it behind the machine enabled a self-propelled road builder of this type to handle 14 cu.ft. of material per linear foot of road on a 14-mi. sand-clay-gravel stabilization project built by the Strom Construction Co., Fargo, N. D., last summer. Addition of the rear-end disposal belt made it possible for the machine to mix windrows containing almost twice the volume for which the travel plant had originally been designed. Mixing rates ranged from 125 to 175 tons an hour and averaged about 150 tons an hour, depending upon the material and its moisture content.

Stabilization Job—Stabilized roadway on the Strom contract consisted of a base course 26 ft. wide and a top course 32 ft. wide, each course having a compacted thickness of 3 in. To complete the entire job required the mixing of about 5,800 tons per mile, or 110 tons per station. Water as required was added to the sand-clay-gravel material at the time of mixing to bring it to optimum moisture content.

TANK TRUCK supplies water added during mixing operation to material in windrow containing 55 tons per station, or 12 to 14 cu.ft. per linear foot, mixed at rate of 175 tons an hour.

EXTENSION SCREWS fitted to standard gathering screws at front of machine assist greatly in feeding sticky windrow of 12- to 14-cu.ft. volume into mixer.

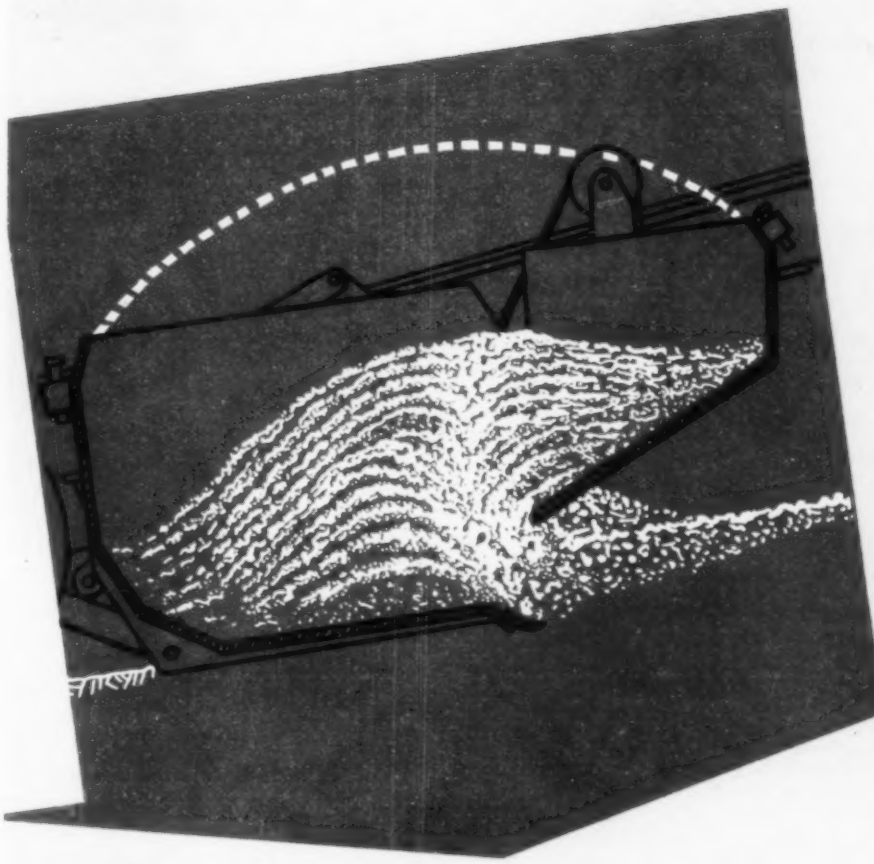
MIXING ON WET SUBGRADE with damp, sticky material, belt conveyor attachment enables machine to handle 55 tons per station without interruption.

Mixing Rate—At the beginning of the job, the first short section was built in three lifts of about 37 tons per station, mixed in windrows containing 7 to 8 cu.ft. per linear foot. Working on windrows of this size, the machine operated at a forward travel speed of 8½ ft. per minute and mixed 180 tons per hour.

After completing the first short section, the travel plant handled the remainder of the 14-mi. job in two lifts, mixing 55 tons per station for each lift, in a windrow containing 12 to 14 cu.ft. per linear foot, depending upon the moisture content of the material. The capacity of the machine varied with the moisture content and

(Continued on page 88)

Here's Why!



THE last yard of dirt goes into a Bucyrus-Erie 4-wheel scraper as easily as the first yard. For this reason, this scraper fills more nearly to its rated capacity in fewer lineal feet than any other scraper on the market. The "double curve" cutting edge, used exclusively on Bucyrus-Erie scrapers, curves concavely across the bowl to throw dirt toward the center. It also has a curved cross-section to throw the dirt centrally upward. As a result, the dirt "boils" up; falls evenly forward into the apron and backward into the rear of the bowl. It does not have to push back, compress or elevate dirt already in the bowl. Consequently, less power is required to fill Bucyrus-Erie scrapers to capacity, and it is possible to use a larger scraper in proportion to drawbar horsepower and weight of the tractor . . . Ask any industrial tractor distributor of the International Harvester Company to show you how these fast, easy-loading scrapers can cut your dirt-moving costs.

BUCYRUS - ERIE

SOUTH MILWAUKEE, WISCONSIN, U. S. A.

Present and Accounted For

A Page of PERSONALITIES

STEPPING UP PRODUCTION for Owen-Ames-Kimball Co., contractor, Grand Rapids, Mich., on projects in vicinity of Bay City, Mich., are four men standing in staircase formation at right. Those in three upper tiers are building $4,000,000 power plant for Consumers Power Co. at Essexville, 6 mi. outside Bay City, while fourth man is engineering construction of bridge to be completed in 1½ years at Bay City. Looking at you, from top to bottom: (1) E. J. MEAD, construction engineer; (2) HAROLD MEAD, general superintendent; (3) F. L. WOODARD, assistant superintendent; (4) H. L. BARGWELL, construction engineer.

HOOVER MEDAL IN ENGINEERING is presented Jan. 18 at annual meeting of American Society of Civil Engineers to JOHN FRANK STEVENS, 86-year-old consulting engineer of Baltimore, Md. Board of award, composed of members from four national engineering societies, cited Mr. Stevens' work on Panama Canal and with Inter-Allied forces in Siberia. He stands **(above)** at base of Marias Pass monument which represents him as he appeared on Dec. 11, 1889, when he discovered that route through Rocky Mountains for Great Northern Ry.

SUPERINTENDENTS (below) on San Jacinto tunnel, difficult 13-mi. bore recently holed through by forces of Metropolitan Water District of Southern California, are (left to right): C. E. SIDES, superintendent, Lawrence adit; B. C. LEADBETTER, general superintendent; and S. J. SHRODE, superintendent, Potrero shaft.

CLEARING SHASTA RESERVOIR AREA. CCC forces are directed by BYRON H. EICH (below, left) superintendent for Bureau of Reclamation at Camp Baird, who here points out course of operations to RALPH LOWRY, construction engineer on dam. When completed, dam will flood 30,000 acres extending 35 mi. up canyons of Sacramento, Pit and McCloud Rivers.

SHOWS ITS CLASS

ON THAT LAST HALF YARD

● It's the heap load . . . that last half yard . . . which makes A-W Tractor Scrapers stand out as exceptional time-savers and money-makers.

These A-W Tractor Scrapers outperform because bit, pan and bowl have been engineered to insure that even flow of material which assures a full load each trip and the chance for profitable yardage every working day.

Austin-Western Tractor Scrapers are available in three sizes —5, 6 and 8 yards. One lever and one cable, control all loading and dumping . . . raising and lowering the bit with trigger-quick action. Wide spread rear wheels track inside the cut, always traveling over even ground, to steady the cutting edge and save power. The pan bottom always remains level while loading. Clearance between the ground and pan is ample for rough going.

These three sizes, with the high-output 12-yard hydraulic control scraper, give you a complete line to choose from, a perfect machine for the tractor you now own or plan to buy!

Write now for full details on the A-W Scraper best suited to your tractor equipment.

The AUSTIN-WESTERN ROAD MACHINERY CO., Aurora, Ill.

Motor Graders
Roll-A-Planes
Rollers
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Crushing and Screening Plants
Washing Plants
Blade Graders

Motor Sweepers
Shovels and Cranes
Bituminous Distributors
Elevating Graders

5-Yard Tractor-Scraper
6-Yard Tractor-Scraper
8-Yard Tractor-Scraper
12-Yard Hydraulic Scraper

For Long Lines... and Rough Going!

GOODALL "MINE KING" AIR DRILL HOSE

Extra tough, smooth cover
Oil-proof tube

Wherever a braided air hose of highest quality is required to meet particularly severe conditions, "Mine King" will pay for itself in long dependable service.

A flexible, high tensile, rubberized cord construction insures freedom from kinking. The tough, extra heavy cover will withstand abrasion and rough handling. A genuine oil-resisting tube is further assurance of long wear and ultimate low cost.

"Mine King" is another Goodall "Standard of Quality" product, and a worthy companion of others in this group. It is made in ½", ¾", 1" and 1¼" sizes. The ½" and ¾" are available in continuous lengths up to 500 feet; the 1" and 1¼" up to 250 feet. All triple cord construction.

Write for samples and prices.

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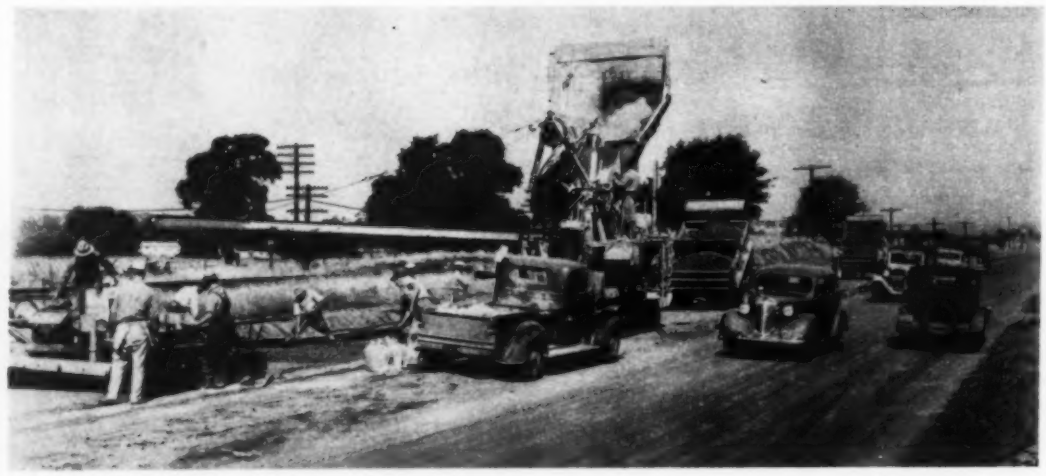
Salt Lake City • Phoenix

GOODALL — The originators of the "Standard of Quality" Line [Reg. U. S. Pat. Off.] of contractors' rubber goods

Mechanical Drag Float

PRODUCES SMOOTH CONCRETE PAVEMENT

(Continued from page 41)



TWO-WAY DETOUR with road mix surface is built to carry traffic around new construction.

fitted to a special 180-ton, four-compartment bunker, the whole to be built into a steel frame.

This suggestion was worked out satisfactorily. The top of the bunker was only 26 ft. from the ground, allowing use of a 1½-cu. yd. clamshell for feeding from nearby stockpiles. Three sizes of coarse aggregates were fed separately into the weigh-box beneath the bunkers by means of small, steel-cleated, endless belts, each operated by a 2½-hp. motor, and the sand was introduced by means of a worm feeder, operated by a 3-hp. motor.

To start the cycle, the operator simply pressed a button and the proper amount of each size aggregate passed in turn into the weigh box under the control of an electric dial scale, carefully set to the proper batch weights for each grade of the material. These settings could be varied from time to time as required by the plant inspector. A manually operated lever, which could not be moved until the weighing operation was completed, was used to dump the contents of the weigh box on to a 24-in. conveyor belt. The latter was operated by a 20-hp. motor which carried the material to a truck-loading bunker having two compartments of one-batch capacity each.

Total energy required to operate the plant, exclusive of the clamshell, was 30½ hp., which represents the sum of the five motors mentioned. The plant operator's job was to keep the two truck bunkers full for each two-batch truck as it arrived. With the conveyor belt just long enough to take one batch comfortably, this was a comparatively easy procedure, assisted by a helper on the loading bunker platform.

With the foregoing outfit, operated by four men, from three to seven two-batch trucks were easily kept busy on an average haul of 1.4 mi., a single batch being put out in 40 sec., if necessary. Using an old 27E paver on the street, with a 50-sec. mixing time per batch, 5,250 cu. yd. of concrete pavement was placed in about 89.9 hr., or at an average rate of 58.4 cu. yd. per hour. The actual operation was spread over 15 calendar days or partial days.

As reported by the resident engineer, the cement yield for the job was exceedingly close—5.02 for a 5-sack mix. This, of course, is attributable to the use of the electrically-controlled proportioning plant.

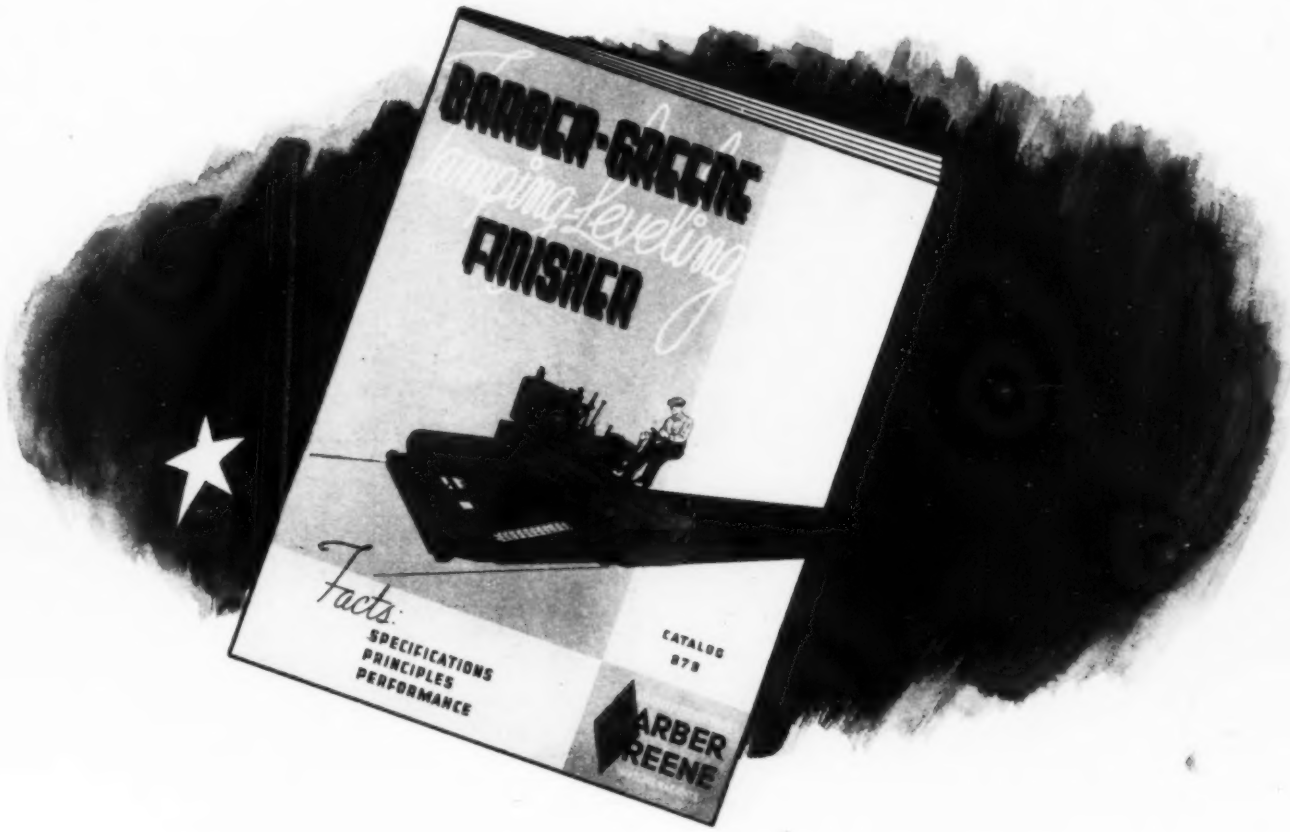
Mechanical Floating—The problem of getting a smooth riding pavement was comparatively simple. The contractor had equipped himself with one of the so-called mechanical drag floats which are now being manufactured in California and which have been successfully operated on several recent paving projects in the state. This machine consists essentially of a number of wooden screeds, three of which are arranged in the form of a large X, with four other units forming V shapes, located between the members of the X. Two of these units are closed V's and are dragged sidewise. The third and fourth units are located in the rear, forming an open V, pointing forward. All, of course, point toward the middle of the X, and all are subject to close adjustment vertically by means of hand-operated screw gages mounted on the running gear above. The adjusting devices are clearly shown in an accompanying picture.

A steel roller, for removing excess surface water, is mounted near the front end of the machine and a burlap belt drag is attached to the rear. Smaller, auxiliary screeds are arranged to keep the excess material away from the tops of the side forms. A water tank of approximately 50-gal. capacity is fitted on the front end of the machine in case it is desired to sprinkle the concrete surface to facilitate the finishing operations, particularly if the latter are somewhat delayed. The whole outfit rides the side forms on plain and flanged wheels, and is powered by a small Ford V8 engine mounted on the front end.

In operation, the machine follows from 100 to 300 ft. behind the tamping finisher and is capable of handling almost any quantity of pavement that can be fed to it in an 8-hr. day. Following is the operating procedure as originally developed, but

(Continued on page 74)

The Significant Feature



will be a Booklet

AT THE ROAD SHOW, the most significant single feature will be a booklet—"The Barber-Greene Tamping-Leveling Finisher." The Finisher itself will be there, but the booklet brings this Finisher to life. It makes you see it work — see how it works — see why it works.

Profusely illustrated, this booklet is all plain facts — basic facts on the basic principles of this ingenious machine — facts on accomplishments—accomplishments in hundreds of miles of jobs — jobs of every type — with every kind of bituminous material — some materials that were previously regarded as impossible with any machine.

This booklet reveals the unique B-G leveling principle fully, it clearly tells and illustrates why the tamping action lays a smooth mat over an irregular base — why the mat stays level under rolling and traffic. It explains the full crawler traction, the large power feeding receiving hopper, and many other advantages. Add the interesting contents of this new booklet to your present knowledge.

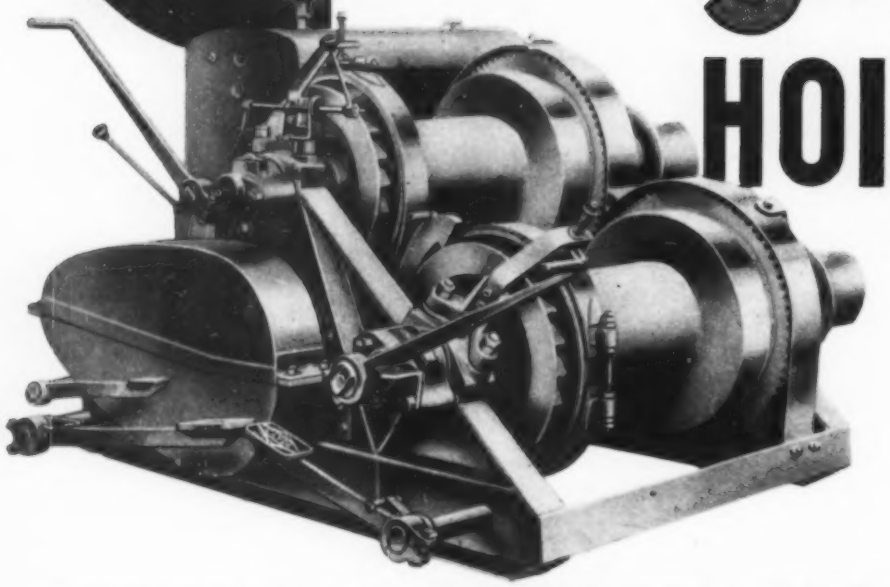
★ Call at Booth B-64 for your copy. If not attending the Road Show, write. Mail requests will be filled starting February 28.

BARBER GREENE
530 West Park Avenue
AURORA, ILLINOIS

39-2

New!

CLYDE 3 IN 1 HOIST



A new, modern, all purpose Clyde gasoline hoist with 3 speeds instantly available on both drums!

Heavy Duty — 7500 pounds on a single line at 200 f.p.m.
Regular Duty — 4200 pounds on a single line at 350 f.p.m.
High Speed — 2500 pounds on a single line at 600 f.p.m.

- Three practical speeds and pulls . . . just shift gears as in an automobile!
- One hoist adaptable to many uses with no lost time for rigging blocks!
- Sturdy construction . . . steel bed and side stands in one rigid piece!
- Economical and dependable power from an 85 H.P. "V-8" industrial gasoline engine!
- Clyde quality throughout . . . generous proportions where necessary for safety and long life!

CLYDE IRON WORKS, Inc.

Duluth, Minn.

CLYDE

THE CLYDE IRON WORKS, Inc.
Duluth, Minnesota
Please send complete specifications and price on the new Clyde "3 in 1 gasoline hoist.

Name .....
Address .....
City ..... State .....

"You'll take pride in your Clyde"

(Continued from page 72)

the procedure is usually varied somewhat to satisfy particular job conditions:

(1). Make two complete rounds (double passes) with the roller in contact with the pavement—no drags down. Roller then is lifted.

(2). Make five or six complete rounds with all screeds down, cutting slightly each trip by adjusting screw gages.

(3). Adjust gages to grade and make two or three round trips with shovel swamper picking up excess grout and patching miscellaneous rough spots.

(4). Lift all screeds and move machine in the forward direction with the burlap belt down. This trip gives a non-skid texture to the final finish, and the machine then proceeds to the next length of pavement ready for finishing.

This mechanical drag float has several distinct advantages:

First, the contractor is relieved of all the uncertainty and grief in organizing and operating his job by hand-finished methods. Contractors who have used the machine would not elect to go back to the old hand tools.

Second, the mechanical drag float gives a pavement which will vialog as low as 3.5 in. per mile. (The pavement under discussion has not, at this writing, been vialogged, although traffic is now using it.)

Third, the machine eliminates at least two wooden push floats as well as the old-fashioned, two-man, heavy longitudinal float. These tools, at best, will not turn out a pavement which will average much better than 8 in. to the mile under the vialog.

With favorable weather, the contractor was expected to finish the job several weeks ahead of his scheduled date for completion.

The project described was built under the direction of the California Division of Highways, C. H. Purcell, state highway engineer; C. H. Whitmore, engineer of District 3; and W. G. Remington, resident engineer.

Pennsylvania Turnpike

(Continued from page 61)

From Blue Mountain tunnel the highway descends to the Cumberland Valley and crosses rolling country at average El. 500 to its eastern terminus, 28 mi. from the tunnel. In this section the formation is shale and limestone.

Bids on First Two Contracts — At the letting of the first grading contract on Oct. 26, bids were offered by 23 representative firms. L. M. Hutchison, Mt. Union, Pa., was awarded the contract on a low bid of $458,058.80. The second bid was $494,205.36, and the third, $499,703.14. Highest bid of the 23 offered amounted to $747,249.10, and the average of the 23 bids was $576,467.76. This contract covered about 9 mi. of construction on 10.3 mi. of route, including two gaps, in the Cumberland Valley.

A second contract, awarded Nov. 29, covered

(Continued on page 76)

Check these IMPORTANT ECONOMICAL FEATURES

Added Resistance to	*. . . plus*
√ FATIGUE	√ EASE AND SAFETY IN HANDLING
√ BENDING STRESSES	√ BETTER SPOOLING ON THE DRUM
√ KINKS	
√ ROTATION ON SHEAVES	

To the user of wire rope every one of these features means a saving of money. And in EXCELLAY Preformed wire rope you get them all! Think what *that* means in terms of economy. So why not get greater value for your money by specifying EXCELLAY Preformed when ordering wire rope. And if you need technical assistance with any of your problems, our engineers will, of course, be glad to cooperate.

We also manufacture standard (non-preformed) wire rope.

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Cleveland, Chicago and New York

COLUMBIA STEEL COMPANY

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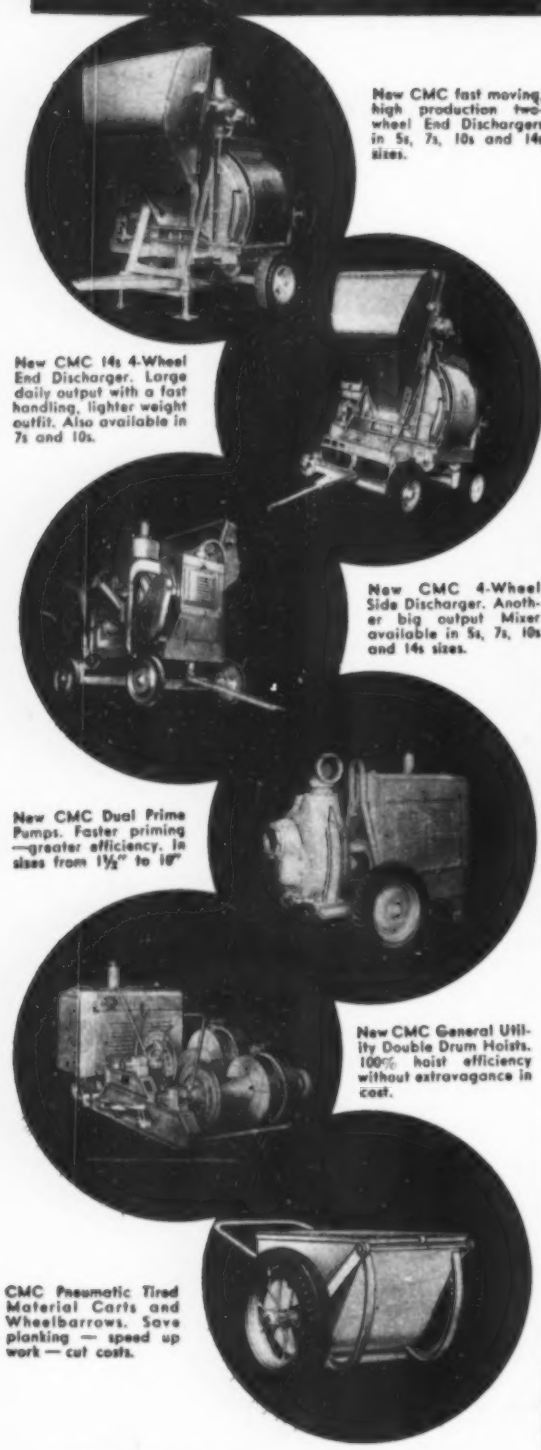
United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

'39 CMC -- The Profit Line for '39



New CMC fast moving, high production two-wheel End Dischargers in 5s, 7s, 10s and 14s sizes.

New CMC 14s 4-Wheel End Discharger. Large daily output with a fast handling, lighter weight outfit. Also available in 7s and 10s.

New CMC 4-Wheel Side Discharger. Another big output Mixer available in 5s, 7s, 10s and 14s sizes.

New CMC Dual Prime Pumps. Faster priming —greater efficiency. In sizes from 1½" to 10"

New CMC General Utility Double Drum Hoists. 100% hoist efficiency without extravagance in cost.

CMC Pneumatic Tired Material Carts and Wheelbarrows. Save planking — speed up work — cut costs.

NEW CMC CATALOG READY!

The brand new CMC catalog —packed with illustrations and information on the entire CMC line including Wonder Tilting Mixers, Saw rigs, Plaster and Mortar Mixers. Yes, it's "the profit line for '39". Write for your copy today.

CONSTRUCTION MACHINERY CO.

WATERLOO, IOWA

(Continued from page 74)

9½ miles of grading, drainage and structures along the Raystown Branch east of Allegheny tunnel — a region of shales and interbedded sandstones. This contract went to Girard Construction Co., Inc., Philadelphia, on a low bid of $444,758.98. The second bid was $487,875.58; and the third, $490,660.06. Twelve firms submitted bids, the highest being $663,561.95. The average of the twelve bids was $553,948.37.

Grading Operations — To move 830,000 cu.yd. of excavation in a contract time of 275 calendar days, L. M. Hutchison operated on his job during the first two months two Bucyrus-Erie 2-yd. diesel shovels and seven Heil 12-yd. carrier scrapers drawn by Caterpillar 95-hp. diesel tractors. It was planned to add two scrapers about the middle of January and to operate after that time two scraper outfits in addition to the two shovel outfits. The earth-moving equipment is supplied and operated by Harry T. Campbell Sons Co., Towson, Md. George H. Keiter, general superintendent for this firm, is in charge of equipment operation, while W. C. Moore, superintendent, manages the job for L. M. Hutchison.

Grading operations are set up to move more than 600,000 cu.yd. with the scrapers and to take care of the remainder, about 225,000 cu.yd., with the two shovels. The scrapers are used on hauls to a maximum of 1,500 ft., and the contractor plans to excavate to a depth of 14 or 15 ft. with the scrapers in all places where the haul does not exceed this distance.

Maximum depth of cut on the job is 47 ft. In opening deep cuts, the contractor takes out the ends with the scrapers until the haul exceeds 1,500 ft. and excavates the remainder with shovel and truck outfits. Below the shallow topsoil, material encountered on the project is practically all shale. Cuts have been excavated to a depth of 35 ft. without striking rock which requires blasting, and the contractor hopes to complete the grading without bringing in drilling equipment.

Fast operation characterized scraper work during the first seven weeks on the job, when the scrapers moved about 150,000 pay yards. Experience showed that each 12-yd. scraper carried about 8.7 pay yards per trip. In one 40-hr. week, a fleet of five 12-yd. scrapers made a particularly good record, moving 27,000 pay yards from cut to fill on hauls ranging from 700 to 1,200 ft. Good operators, who have worked on scrapers with the Campbell firm for three years, make such records possible. A LeTourneau heavy-duty rooter rips up the shale in advance of the scrapers and facilitates loading.

OLD DRILLING PLATFORM remains standing in west heading of Kittatinny tunnel. Original railroad builders excavated about 4½ mi. in total of 7 mi. of tunnels to be utilized by highway.

On shovel excavation, the 2-yd. units load about three dippers per minute. In an 8-hr. day, one of the shovels put out 450 truckloads, loading three dippers per truck. An average load is figured to yield 3 pay yards.

To handle any rock that may be encountered and to serve other purposes on the job, the contractor has five Euclid crawler-mounted 14-yd. side-dump wagons drawn by Allis-Chalmers 80-hp. diesel fuel tractors. The job also is equipped with three smaller shovels, 1¼-yd. and ⅝-yd., for drainage and structural excavation.

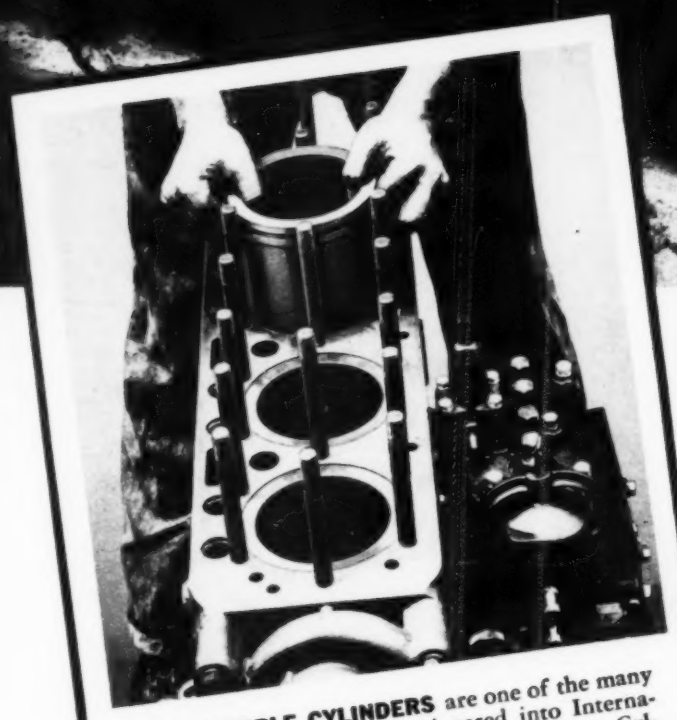
Material from the cuts is spread in 8-in. loose layers on the fills by the scrapers or by tractor-bulldozers and is compacted with 10-ton three-wheel rollers.

Turnpike Organization — Field work on the turnpike outside of tunnels is directed from four division offices, at Shippensburg, Everett, Somerset and Mt. Pleasant. A separate tunnel division in the headquarters office in Harrisburg designs the tunnels and directs their construction. Walter A. Jones is chairman of the Pennsylvania Turnpike Commission, Samuel W. Marshall is chief engineer, and R. B. Stone is chief construction engineer. Retained as technical advisers to the Turnpike Commission are H. H. Allen, consulting engineer, of the J. E. Greiner Co., Baltimore, Md., and

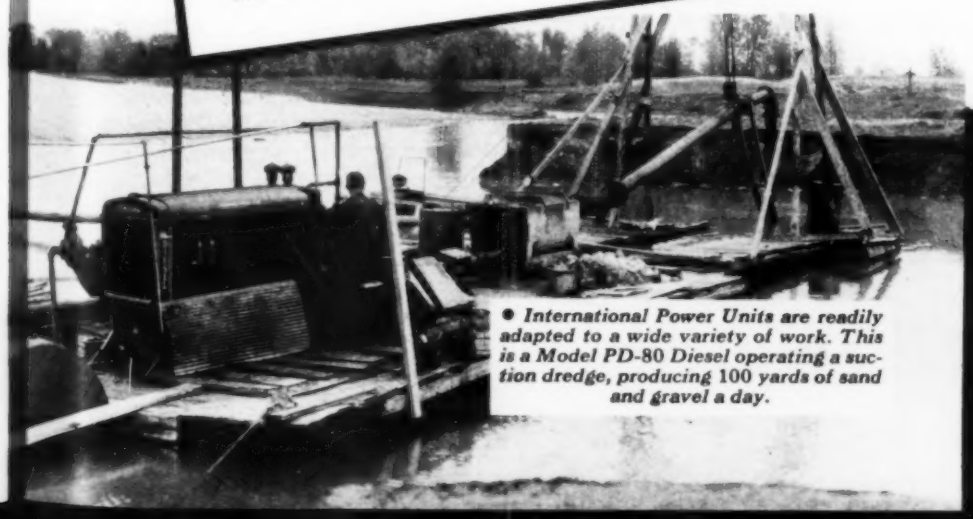
(Continued on page 78)

INTERNATIONAL Power...
Engineered for *Plus* Performance

International TracTracTors have a great reputation for their fast, flexible operation under tough conditions. This is the Model TD-40 Diesel doing its stuff on an earth-moving job.



REPLACEABLE CYLINDERS are one of the many money-saving features engineered into International Industrial Tractors and Power Units. Cylinders may be removed and replaced with new cylinders of the same size. These new cylinders, with new pistons, fully renew the original engine compression and efficiency. This feature saves International owners the cost of expensive reboring operations.



• International Power Units are readily adapted to a wide variety of work. This is a Model PD-80 Diesel operating a suction dredge, producing 100 yards of sand and gravel a day.

• There are many sound and practical reasons back of the wide preference for International Industrial Power. When you buy International you buy low-cost maintenance, long life, and performance and economy that produce profit on the job . . . the result of the skilled engineering that goes into every detail of International Harvester *quality* products. There are TracTracTors (crawlers) and wheel tractors for gasoline and Diesel operation, and 11 models of power units, gasoline, Diesel, and gas, ranging up to 110 max. h.p., in the International line. Check into these tractors and engines and see for yourself how they fit into your operations. The nearby International industrial power dealer or Company-owned branch will demonstrate the efficiency and economy of International Power any time you say.

INTERNATIONAL HARVESTER COMPANY
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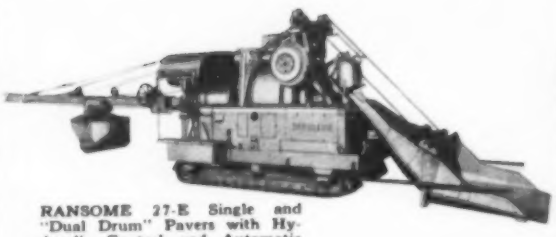
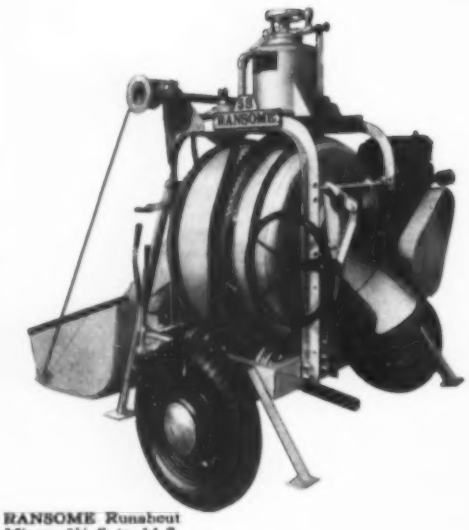
INTERNATIONAL INDUSTRIAL POWER



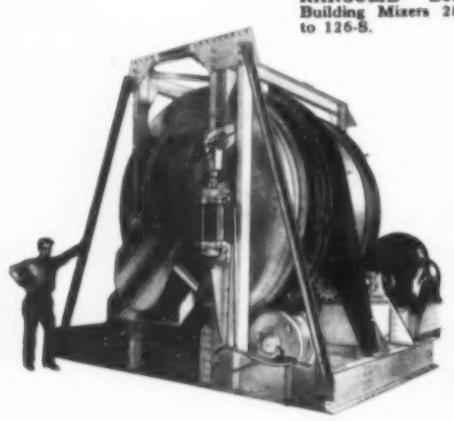
RANSOME 27-E Single and "Dual Drum" Pavers with Hydraulic Control and Automatic Hydraulic features. Also special Pavers with Inclined Booms and Towers available.

RANSOME Truck Mixers and agitators — Truck Mixers 1½, 2½, 3½, 4, 5 cu. yds. Agitators 2, 3, 4½, 6 and 7 cu.yds.



RANSOME Runabout Mixers 3½-S to 14-S.

RANSOME "BIG" Building Mixers 28-S to 126-S.



If you Handle or Mix Concrete

You will be particularly interested in the many NEW developments and improvements that are continually being made in the complete line of RANSOME Equipment for—

- ✓ Simplified Control
- ✓ Increased Production
- ✓ Advanced Design and Simplified Construction
- ✓ High Quality (better mixed) Concrete
- ✓ Economical Operation and Maintenance
- ✓ Longer Life

If you have any Concrete Mixing or Handling Problem — put it up to RANSOME.

Learn all the facts about the equipment in which you are interested.

Send for latest Bulletins—today!

RANSOME CONCRETE MACHINERY CO.

Dunellen, N. J.

Cable Address: — "Racomaco" Dunellen

Ransome

CONCRETE EQUIPMENT

Backed by 89 Years of Experience

Since 1850

Everything in Mixing & Handling Machinery for Concrete

(Continued from page 76)

Ralph Smillie, consulting engineer on tunnel design, of the Port of New York Authority.

Funds for the project were provided by a $35,000,000 loan from the Reconstruction Finance Corp. and a grant, not to exceetl a maximum of $26,100,000, from the Public Works Administration. A separate PWA unit has been established in Harrisburg to supervise construction of the turnpike. James F. Murphy is project engineer in charge of this unit, and Harold C. Lightfoot is assistant project engineer. Representing the interests of the RFC is Col. F. E. Lamphere, inspecting engineer.

PUBLIC RELATIONS

(Continued from page 39)

interest in the contract is furnished by the District office with the approval of central office. The resident engineer and his several assistants must be men of high calibre — well schooled in contractor and public relations — and able to apply good judgment in any emergency.

Contractor relations during the period of construction are not necessarily difficult when there is an understanding and cooperating spirit on both sides. On the other hand, public relations during the term of the contract are apt to be misunderstood, since the public little appreciates the difficulties inherent in a highway contract. Much care, therefore, is expended by the Division of Highways representatives in handling traffic in or around construction projects. Detours are established so as to impose the least possible inconvenience, to obtain the greatest safety, and to require the least loss of time to the motorist. Adequate signs for the control and direction of traffic are placed and maintained. Frequently flagmen are necessary for traffic safety — they are carefully chosen. Flagmen, incidentally, are clothed in red coats and thoroughly instructed as to their duties.

Through the medium of the daily and weekly press the public is kept advised as to the status of the contract so the location of the project and its progress may be known — that motorists may be guided accordingly. A thoughtful consideration of the problem of the adjacent roadside vendor who is cut off from public contact by reason of road construction or reconstruction is always given, and every effort made to reduce the inconvenience caused by the work.

Many miles of California highways lie through highly cultivated areas. In the preparation of plans for construction through these areas consideration is given to the dust problem and means to avoid this menace are provided. Appreciating the problems of the adjacent land owner, and endeavoring to meet these problems prior to complaint does much to promote pleasant public relations with the Division of Highways.

The problems of bridge construction are, in the main, the same as the problems of highway

(Continued on page 80)

REACHING NEW HEIGHTS!

New heights of rope safety and economy are being gained through the use of Roebling "Blue Center". Investigate this rope, the highest development of Roebling's over 90 years of rope making experience.

JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N.J.
BRANCHES IN PRINCIPAL CITIES

STRONGER—Wire of highest strength consistent with ductility and toughness

TOUGHER—Provides maximum resistance against wear, sudden shocks, vibration

SAFER—Unequalled for uniformity of quality

SAVING—Insures lowest general average operating cost

THE HIGHEST DEVELOPMENT IN ROEBLING WIRE ROPE

MODEL P-A PLANTS ARE BUILT IN 4 SIZES

MODEL PA-15
1500 ≠ Mixer

MODEL PA-20
2000 ≠ Mixer

MODEL PA-30
3000 ≠ Mixer

MODEL PA-40
4000 ≠ Mixer

A NEW PORTABLE ASPHALT PLANT

in completely assembled sectional units easily moved by truck or rail and quickly erected without the use of a crane or gin pole.

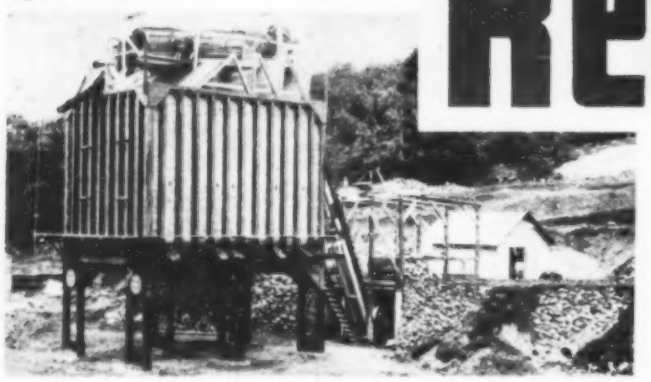
Patents applied for — Built in 4 Sizes

Write for Bulletin T-260

HETHERINGTON & BERNER, INC.

701-745 Kentucky Avenue — Indianapolis, Ind.

Either way—make it a **Reliance**



CRUSHING PLANT

A complete unit—rapidly set up, inexpensive to operate, insuring large capacity, very little vibration. Crushing, elevating, washing, screening done on spot, materials stored in Reliance Steel or Wood Bins (completely fabricated, easy to erect). Experienced contractors put these Reliance Units together quick to meet any job capacity — at a profit. You, too, will do well to investigate.

PORTABLE *with* V-BELT DRIVE

Whether you use this Reliance Portable Crusher alone or in combination with an Elevator, Chute Screen, etc., you can get no better value for your money in terms of capacity, low operating cost and rugged durability. The Reliance Crusher is famous for its strength and simplicity. It is particularly stable. A "swell" buy for crushing on any job. Send for detailed circular.

PRODUCTS:

Reliance offers a complete line of **Rock Crushers; Bucket Elevators; Revolving Screens; Storage Bins; Pulverizers; Chip Spreaders; Heating Kettles; Bin Gates; Feeders; Belt Conveyors; Grizzlies; Air Separators; Sand and Gravel Spreaders; Wash Boxes.**

UNIVERSAL ROAD MACHINERY COMPANY

KINGSTON, N. Y., U. S. A.

DISTRIBUTORS in ALL PRINCIPAL CITIES of U. S. A.

(Continued from page 78)

construction in their relation to the public. The Bridge Department provides adequate detours, signs them properly, and keeps the public informed as to the progress of the work.

Traffic Safety

Safety on our highways is the great concern of many individuals and organizations. The problem has become more serious because in recent years manufacturers have increased the normal speed of the vehicle—both trucks and touring cars. There has been a decided increase in the use of large busses and of trucks and trailers operating at high speed. This means increased hazards for both approaching and passing vehicles.

The present 10-ft. width of traffic lane provides insufficient clearance for this increased volume of vehicles, both large and small, operating at greater speed. The timid driver hesitates to pass trucks with trailers and the wide busses on the 10-ft. lane and this has a tendency to pile up cars behind him and to require a longer time limit for passing. The record of traffic accidents in California shows that the percentage of overtaking accidents or sideswiping is in excess of the approaching type of accident. Evidently more clearance is needed. Experience and observation both confirm the conclusion that a 10-ft. traffic lane is no longer adequate for modern high-speed traffic.

The California Division of Highways has adopted a new standard of construction for state highways which provides for an increased width of lane. The present 10-ft. lane is to be widened to a basic 11-ft. width, making the two-lane roadway 22 ft. wide instead of the previous 20 ft. A standard of 11-ft. width of lane for three-lane highways has also been adopted and these will be designed to provide for future expansion into four-lane divided highways with minimum loss of investment.

The multiple-lane highway of four lanes, or more, will be a divided highway providing for two roadways in each direction with a dividing or separating strip between them. The standard of construction adopted for these roads is a 12-ft. width of lane for the inside lane adjacent to the dividing strip and an 11-ft. width for the outside lane. The inside lane of 12-ft. width will provide more freedom for the car traveling in this lane while passing and greater freedom and mobility in case of crowding. The outside lane does not require this additional width since it has a shoulder still available to maneuver upon in case of necessity.

Only a relatively small percentage of our highways will be of the divided type. The majority of our roads will always continue to be two-lane roads since that width will accommodate the volume and character of traffic using them. Our planning of the narrower roads now constructed must consider the ultimate development or we will be forced to waste some parts of the pavement.

To conform to this additional width of pavement on the roadway we are also increasing the width between curbs of structures such as bridges and grade separations. The additional width provided is 2 ft. beyond the edge of the pavement lanes. In other words, a bridge on a two-lane highway having a 22-ft. width of pavement will be 26 ft. wide between curbs and the clearance on a structure on a divided roadway will be 27 ft. between curbs for each roadway. Three-lane roads are being built to make them easily adaptable to future expansion into the divided type. This design consists of building two lanes of per-

(Continued on page 82)

NOW! BE THE WINNING BIDDER FOR PROFITABLE JOBS LIKE THIS

There's no money in it for you if you're forced, by a too-high bid, to sit back and watch the other fellow get the concrete job you wanted. But the chances are that *you'd be the one to get the job and the profits* if you'd figured the cost of mixing, hauling and placing the concrete with Rex Moto-Mixers. For with Moto-Mixers' dependable, low-cost performance as a basis, you can keep your bidding figures low — and have confidence in Moto-Mixers' ability to see the job through at the estimated cost.

THE ONLY TRUCK MIXERS WITH THESE 4 VITAL FEATURES!

1. **REX FLEXIBLE CHAIN DRIVES** — Positive, shock-and-twist-absorbing, acknowledged the most efficient means of transferring power to heavily loaded mixing drums. Lighter than gear-type drives, saves wear and tear on mixer and truck.

2. **REX SINGLE CONE-END MIXING DRUM** — Facilitates rapid loading; reverses flow of materials, giving natural end-to-end action for fast, thorough mix; simple drum blading for better mixing, cleaner drums.

3. **REX NO-FLOOD WATER TANK** — Eliminates chances for error—measures the exact amount of water for each batch, draining off the surplus. No excess mixing water is carried on the truck, weight is saved, spoiled batches are prevented.

4. **REX LOW LOAD CENTER AND LIGHT WEIGHT** — Moto-Mixers are *several hundred pounds lighter than other mixers of their size — can haul a larger payload with a given gross load weight!* Yet they are better balanced, easier to handle, built for longer years of service.

REX

CHAIN BELT COMPANY *of Milwaukee*

MOTO-MIXERS

SEND TODAY for your copy of the book "Payloads" which gives detailed descriptions of all of Moto-Mixers' many exclusive design features. See how they can help you outbid the field! Use this coupon.

CHAIN BELT COMPANY
1664 W. Bruce Street, Milwaukee, Wisconsin

Please send me my copy of "Payloads."

Firm Name .....

By (title) .....

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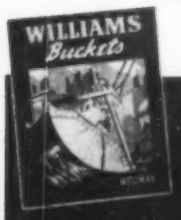
City ..... *State* .....

Right Down to Fighting Weight!

You want more than dead weight in a bucket to lick a tough digging job. You want speed — agility! Williams design, welded construction, and special alloys insure stamina and ruggedness, without excessive weight. Williams Buckets carry plenty of weight, but they carry it in the right places and in the right proportions. You move more materials in less time with Williams Buckets—and that's profitable. ...and if that's what you want in a bucket, you'll find your particular type in the Williams Catalog. It's free!

THE WELLMAN ENGINEERING CO.
7017 CENTRAL AVENUE • CLEVELAND, OHIO

Send for Catalog

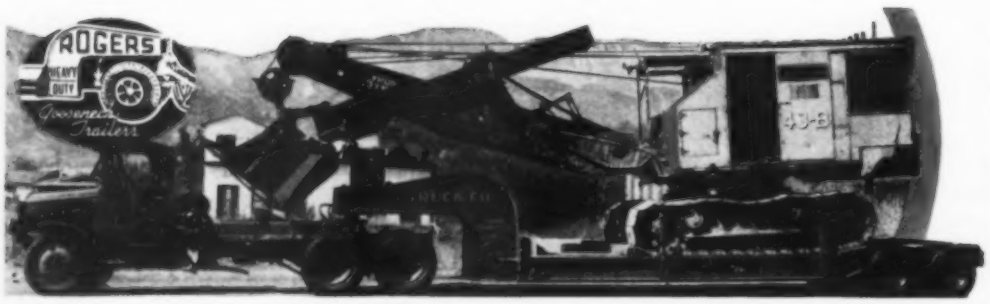


Distributors located in all parts of the country represent the Williams Line of Power-Arm, Multiple Rope, Power-Wheel, Single Line, Hook-On and Dragline Buckets.

WILLIAMS *Buckets*
***built by* WELLMAN**

★ BUILT TO LAST...*and* MOVE DIRT FAST! ★

ROGERS BRAKES



ASSURE POSITIVE CONTROL

The New Rogers system of equalizing brakes affords absolutely dependable control of the trailer, making it possible to haul heavier loads more quickly and more profitably and with assurance and safety.

ROGERS BROTHERS CORPORATION
220 Orchard Street
ALBION, PENNA.

•EXPERIENCE *built it...*

•PERFORMANCE *sold it...*

(Continued from page 80)

manent pavement separated by an intervening lane of lighter type construction. The middle lane can then be converted into a dividing strip without appreciable loss and will serve in the meantime as a traffic lane for passing until traffic volume requires the increased capacity. This type of construction, characterized by the contrasting color of the separate lane, has a decided controlling effect on the operation of vehicles since it definitely demarks the separate lanes in which they are to travel.

A minimum width of 4 ft. has been adopted for the separation strips on the divided roadway. A curb 6 in. high, with a batter of 4 in., will prevent promiscuous use of this central strip but it should not be too high and should have a reasonable amount of slope so that it will not present an additional hazard. Our studies at present indicate that with division strips of 20 ft. or more in width, curbs will not be necessary.

It must be recognized that adoption of higher standards of construction — the expansion of lane width, the divided type of roadway, the increased width of right-of-way necessary for this type of construction and the improvement of our intersections — will further complicate our already acute financial problem. Not many of our citizens realize that California has within her borders some 2,328,000 registered motor vehicles comprising 8.3 per cent of the nation's total, while the motor vehicle and gas tax revenues available to the Division of Highways for maintenance and construction represent but 3.7 per cent of the revenues collected by the various states. The movement of vehicles on our highways is increasing rapidly and approximates now some 18,000,000,000 vehicle-miles per year. This may possibly account for the fact that at each budgetary period there are presented, by interested parties, meritorious construction projects totalling some twenty times the revenues available for construction.

This is a serious problem but our mounting highway accident toll is more serious. The time has come to face this issue squarely. We must build the safest highways possible even though it be a definite curtailment in the total mileage constructed. Granted that our divided type of highway and the wider traffic lane alone will not solve the accident problem, we still must contribute our share toward its solution. Such a policy will be economically sound from the savings on the obsolescence factor alone and will be a desirable and notable contribution to safety and planning for the future.

Maintenance Operations

By the very nature of its operations, the maintenance department of the California Division of Highways has the greatest amount of public contact, and must maintain a more carefully laid out program for the promotion of its work. Highway or bridge construction carries on for but a short period of time; maintenance operations must follow indefinitely.

To the maintenance department there is also allocated all the various smaller items of work and duties to perform such as counting of traffic, maintaining of road stripes, signs, and signals, the problem of snow removal, roadway repair and storm damage, the operation of bridges, roadside beautification, illegal sign removal, the issuance of permits for the movement of loads otherwise prohibited under the Vehicle Code, and a thousand

(Continued on page 84)

Sorry, Jim, But Your Bid Was Too High!

It may strain old ties when you lose a job on price. But cost is still uppermost to the man who pays the bills — and that applies emphatically to excavating jobs.

If you still operate old type shovels, you'll find it increasingly difficult to compete with the new P&H excavators built of alloy steels. It's far wiser to work with them than to let them work against you.

Like hundreds of other owners, you, too, can cut your excavating costs with a P&H—five years ahead of the field. Harnischfeger Corp., 4494 W. National Ave., Milwaukee, Wis.

P&H PACEMAKERS · *Save money on the job.*

17 DIFFERENT MODELS

From ⅜ to 5 cu. yds. capacity. Gas, Diesel or electric power. Write for literature on the size and type that interests you.

P&H

HARNISCHFEGER
CORPORATION

EXCAVATORS · ELECTRIC CRANES · ARC WELDERS · P&H · HOISTS · WELDING ELECTRODES · MOTORS

Put them on the toughest jobs... and then forget them!

"GJ-BOSS"

GROUND-JOINT

FEMALE COUPLINGS

Style X-34

The dependable, trouble-free service these couplings provide has established new standards of efficiency and economy in every type of service. No leaking or lost washers. No time out for replacing worn washers. A copper insert in the spud fits the accurately machined rounded head of the stem, forming a soft-to-hard metal seal that remains *leak-proof*, regardless of wear.

The definite advantages of "GJ - Boss" couplings more than compensate for a slight additional first cost. They are designed and manufactured to insure maximum safety and long life, with important savings in maintenance and replacement costs.

Stocked by Leading Rubber Manufacturers and Jobbers.

DIXON
VALVE & COUPLING CO.

MAIN OFFICE AND FACTORY

PHILADELPHIA

Branches: *Los Angeles, Birmingham, Houston*

(Continued from page 82)

and one other duties to which a maintenance man falls heir.

The maintenance department is in itself a public relations department, and every employee has been deeply schooled in courtesy to the public. Maintenance men are constantly on the highway. They are constantly observed by the traveling public and noticed by the adjacent land owners, and while as public employees they are public servants, they must nevertheless be firm, fair, and courteous in their actions. Men of the maintenance crews daily render aid to motorists in stalled cars, frequently towing cars to garages, furnishing gas and making minor engine adjustments when a machine ceases to function on isolated stretches of road.

Maintenance activities on the pavement itself must be conducted in a manner so as to inconvenience the traveling public as little as possible. Furthermore, these maintenance activities must be brought to the notice of the public in a firm and courteous manner so that hazards to the workmen and to the motorists will be reduced to the minimum. Properly worded and placed signs are a prerequisite.

The maintenance life is a hazardous one, and public appreciation of this fact must be developed and extended. The press is much needed in this effort, whether it be in a news story to tell the hazards of the work or in the reporting of accident or court cases where careless motorists have overlooked the fact that highway workers must labor on the roadway and are not there to inconvenience them or to be injured by them.

The maintenance man in his relationship to the adjacent property owner does much to carry on a proper public relation for the Division of Highways. Questions of drainage, material for roadway repair, of slide removal, of weed eradication, and many others all tend to create a happy public relation if properly managed.

While the general public does not wish to be inconvenienced by oiling operations or held up because of storm damage and repair, there is nevertheless a pleasant understanding on the part of the motorists that maintenance men must interfere with highway traffic so as to do these things and that in so doing they push road projects to completion as rapidly as is possible. Very little criticism is heard from motorists who are placed under control through oiling operations or road repair operations.

That the public may be informed in general about road conditions, the maintenance department of the central office of the Division of Highways releases weekly to the press a report of road conditions throughout the state. In the winter months additional information is broadcast through a local radio station concerning snow sports areas and the availability of routes to them. During storm periods when roads are sometimes under control reports of adverse conditions and hazards to be encountered are reported to the press and to the Automobile Clubs for dissemination to the public.

The maintenance department of the California Division of Highways is of major importance in the promotion of pleasant public relations, and the high respect which the public holds for this department is ample proof that this relations policy is properly founded.

California has one of the most modern civil service laws in the United States, and follows

(Continued on page 86)

Working for the
U.S. ENGINEER OFFICE

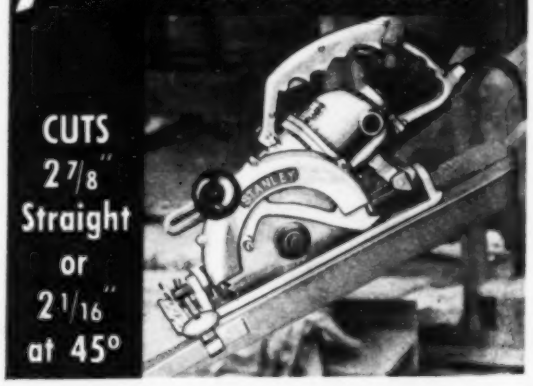
2 UNION HAMMERS
on a long cutoff wall, Kingston, Pa.

Photo shows only one—but there are two on this job of flood control work, in charge of the Sub-office at Kingston. Union Pile Hammers are picked for fast, low cost driving because of their strength and simplicity. Their one piece frame, few parts, special metals and economy in steam or air consumption, make UNIONS the first choice of experienced contractors.

Send for Union Catalog—showing complete line of Hammers and other Union Contracting Equipment.

UNION IRON WORKS INC.
Engineers and Manufacturers
Spofford and Lidgerwood Aves., Elizabeth, N. J.

***New!* STANLEY SAFETY SAW**



- - with unique Duplex Handle that affords ease in any position

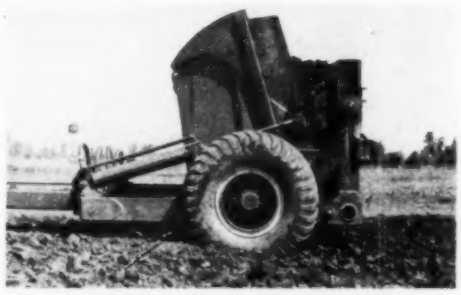
Duplex Handle on new W8 Saw has two gripping positions, with trigger switch at each, for a comfortable "feel or hang" no matter what position your sawing requires. One adjustment controls depth of cut to maximum of 2 7/8" with blade square with base, or 2 1/16" with blades set at 45° with base. Universal motor for 110 to 250 volts as specified. Full equipment and Saw come in handy steel carrying case. Try this new Saw at your distributor's, or write for literature. Stanley Electric Tool Division, The Stanley Works, 140 Elm Street, New Britain, Conn.

STANLEY ELECTRIC TOOLS
"COST LESS PER YEAR"

MORE PAY LOADS *with these New*

BAKER Hydraulic SCRAPERS

CLEAN, SMOOTH CUTS



SPREADS EVENLY AS IT DUMPS

Ask for special Bulletins on Baker Scrapers, Bulldozers and other Baker Products.

THE BAKER MFG. CO.
568 STANFORD AVE.
SPRINGFIELD, ILLINOIS

If you want more pay loads — quicker, easier digging, hauling and dumping at less cost — be sure your next scraper is a Baker.

The flat digging angle, used so successfully in the old type slip scraper, causes the rear of the pan to be loaded first, instead of piling up the dirt in front. Baker Scrapers thus get a full load faster, in a shorter distance and with much less power.

The flat digging angle remains practically constant regardless of the depth of the cut, keeping smooth, even grades. When the pan is raised, the rear of the scraper automatically rises to afford ample clearance for hauling, dumping and spreading. The Scraper dumps cleanly and spreads evenly.

An efficient hydraulic system, the result of twenty years' experience, insures perfect control. Alloy-steel construction combines light weight and great strength. Available in sizes for use with 20-horse power tractors up.

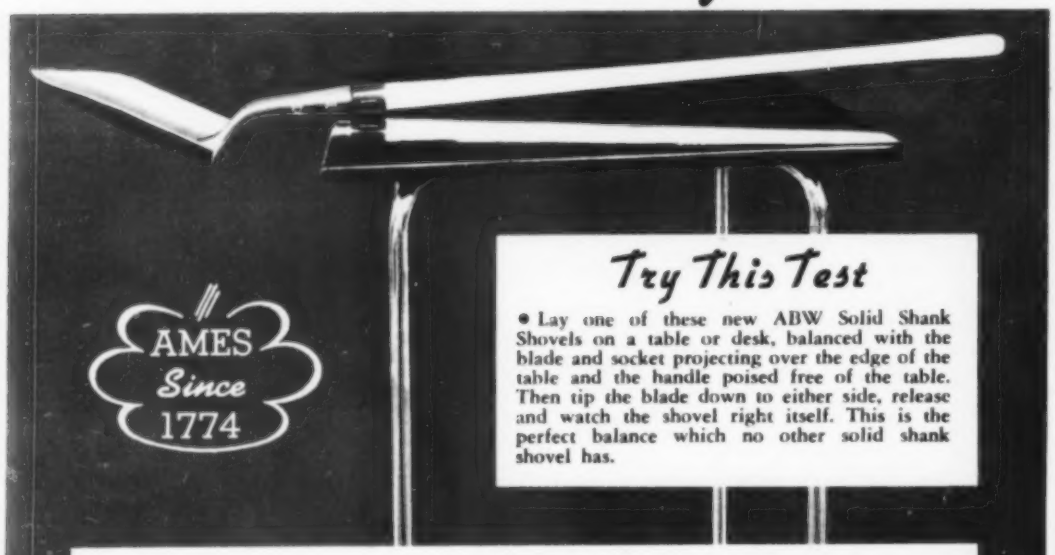
BAKER BULLDOZERS

Baker Bulldozers handled the bulk of the earth moving jobs at the New York World's Fair site. Their sturdy, simple construction, twin-cylinder, direct lift operation and accurate control make them the choice of contractors for important jobs everywhere.

• BAKER TRACTOR EQUIPMENT •

BULLDOZERS • GRADEBUILDERS • SCRAPERS • ROOTERS • ROAD DISCS • MAINTAINERS • SNOW PLOWS

The Shovel With The Perfect Balance



Try This Test

● Lay one of these new ABW Solid Shank Shovels on a table or desk, balanced with the blade and socket projecting over the edge of the table and the handle poised free of the table. Then tip the blade down to either side, release and watch the shovel right itself. This is the perfect balance which no other solid shank shovel has.

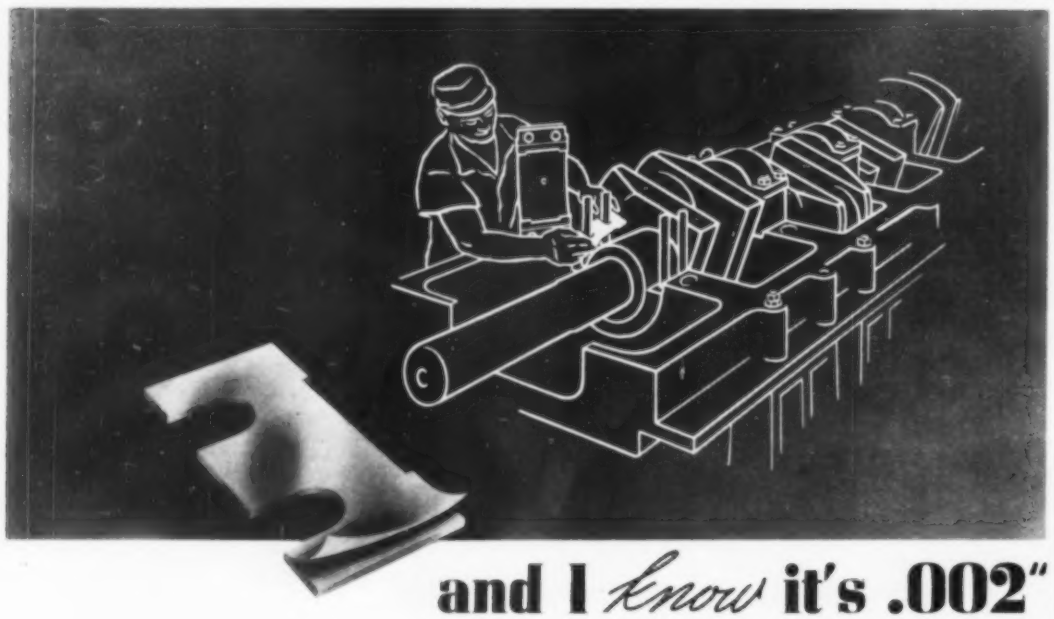
● A new re-designed socket gives to the ABW Solid Shank Shovel a perfect balance. The new high bend has achieved for this famous shovel a balance unequaled in any other solid shank shovel.

To the users of shovels this is a most important development and one that will be welcomed by buyers of shovels. Added to this exclusive feature ABW Solid Shank Shovels are equipped with the famous Shock Band, which gives more handle strength to the shovel.

Made from one solid bar of steel ABW Solid Shank Shovels are the strongest shovels made, give the longest service and with their perfect balance, make for easier shoveling. Ask your jobber about this new re-designed bend and the perfect balance.

AMES BALDWIN WYOMING CO., Parkersburg, W.Va., North Easton, Mass.

ABW Products: Shovels, Spades, Scoops, Forks, Hoes, Rakes, Post Hole Diggers, Agricultural Handles



and I *know* it's .002"

● The assembly mechanic knows his LAMINUM shims. He knows that each of the .002 (or .003) inch thick laminations he *peels* from this brass shim, will leave a smooth, hard surface and absolutely uniform thickness. He can be sure of a quick precision adjustment—right at the job. No filing, grinding, machining. ● Do you wonder that best-known machine manufacturers throughout industry . . . *and leading aircraft builders* . . . profit by LAMINUM convenience and cost-cutting in assembly or repair? ● We supply Laminum shims cut to your exact specifications. For maintenance use, Laminum sheets are obtainable from your mill supply house.

LAMINATED SHIM CO., INC. 21-76 44th Avenue, L. I. City, New York, N. Y.

Cleveland Dallas Houston Milwaukee Tulsa

LAMINUM

THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

Application Chart FREE Write us for new file-folder illustrating the many types of bearings in which LAMINUM shims find application. For handy practical use. With it a sample of Laminum.

1146

(Continued from page 84)

closely the tenets of the merit system. All regular employees are under civil service. Most employees look at their employment as a career service. In service training is a further principle of the merit system. With these principles established and recognized as fundamentally proper, the Division of Highways does much to encourage the beginner in each branch to avail himself of the opportunities which are presented to increase his knowledge and usefulness.

All employees are trained and given experience under supervision to handle properly the position which they hold, following which they are given the opportunity to fit themselves for advancement by assisting in and working on more difficult work. Several of the departments hold round-table meetings or discussion groups for the purpose of discussing various phases and problems of their work, and as an aid in the development of their personnel. Some of these groups have outside speakers bring information on subjects relating to the work.

In many of the field offices a discussion group or conference program is followed by the smaller departments and as frequently as once a week the district heads bring together the department heads to discuss matters of policy, the operation of the department, and personnel.

Under the Civil Service Act of California semi-yearly reports of the efficiency of each employee must be filed with the Division of Personnel. The preparation of these reports and the conferences held between the employees and supervising officers does much to clarify and answer employee difficulties that might arise.

Eighteen thousand employees of the State of California are organized into the California State Employees' Association. This association is manned by employees from all ranks. In the Division of Highways there are several chapters of the association throughout the state. On the boards of these chapters sit employees from the laboring ranks of the maintenance department together with high supervisory officials, all with the one common thought — the furtherance of the efficiency of the state employee of California.

Public and employee relations of the Division of Highways are jealously guarded, and it is honestly felt that few departments of the size of this department have such friendly relations with the public, on the one side, and such high cooperation of its employees on the other side.

Rivet Bolts Approved

For Structural Connections

RECOGNIZING THE NEED for quiet in the vicinity of hospitals, New York City's Board of Standards and Appeals has approved the use of Dardelet rivet-bolts, instead of rivets driven by pneumatic guns, for the structural steel connections of a nine-story addition to the Fifth Ave. Hospital at 105th St. The erection of 1,300 tons of steel in the new structure required the use of 18,000 rivet-bolts of carbon manganese steel, formed with a button head and a ribbed grip body section slightly greater in diameter than the punched and drilled holes in the structural steel members. The bolts are driven into the holes with an 8-lb. maul to produce a bound fit. A self-locking screw thread holds securely a nut turned up on the other end of the bolt.

BIG YARDAGE DIRT CHEAP

DIESEL LORAIN-40 DRAGLINE handles 120 yds. per hr. on 1½ gal. of fuel oil

● This ¾-yd. Lorain-40 of T. Jensen's, Stockton, Calif., is shown riding herd on a 60,000-yd. levee job along the San Jauquin River for the El Soeyo Ranch. A roundup of performance facts shows that this dragline moved an average of 1000 to 1200 yds. per 10-hour day; consumed 1⅛ to 1½ gallons of fuel oil per hour; had a drag cable life of 20,000 yds. And just to top off a perfect record the Lorain-40 handled the 60,000 yds. of difficult digging without a single time out for repairs.

Now for the reasons back of the record. First, a crawler with 30" wide treads provides both low ground pressures and sure footing. Second, the patented dragline fairlead eliminates costly cable wear. Third, the thrifty Caterpillar Diesel engine gives greater power at lower cost. And fourth, the Center Drive turntable is balanced to give the minimum weight and the maximum stability—which permits this 30,000-lb. unit to handle a full ¾-yd. bucket speedily and efficiently.

These and many other features make the Diesel Lorain-40 an equally outstanding performer whether used as a dragline, shovel, crane, or clamshell. Write for catalog today.

UNIVERSAL CRANE DIVISION • THE THEW SHOVEL COMPANY
LORAIN, OHIO

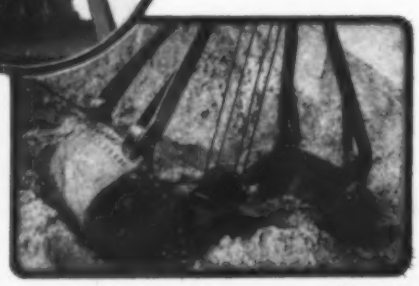
THEW CENTER DRIVE

"Moves More Material, Faster, at Lower Cost"

3/4 YD LORAIN-40

MICHIGAN POWER SHOVEL Co BENTON HARBOR, MICHIGAN, U.S.A.

"Wear INSURANCE" *is built into every* Owen Bucket



Efficient operation is of first importance in a bucket, but long service with freedom from repairs is equally essential.

In many important details, Owen design is conducive to this long, satisfactory operation. Read, in the new catalog about protected sheaves, sealed shaft bearings, one-piece non-wobbling head, non-chafing cables, etc.

The OWEN BUCKET Co.
6020 Breakwater Avenue, Cleveland, Ohio
Branches: New York Philadelphia Chicago Berkeley, Cal.

Pugmill Travel Plant

(Continued from page 68)

with the nature of the material being mixed.

Operating under average good conditions on a 55-ton windrow, the mixer traveled at 5¼ ft. per minute, producing about 175 tons of stabilized mixture per hour. To get compaction, moisture content ordinarily varied between 10 and 12 per cent. When the moisture content increased as the result of rains or of wet material from the pit, the windrow became sticky, requiring greater power for initial mixing, with corresponding reduction in forward speed. Under these unfavorable conditions, production dropped at times to a minimum of 125 tons an hour, but the machine was able to maintain continuous operation at the reduced rate.

Belt Attachment—A belt conveyor attachment ordinarily improves mixer operation on windrows exceeding 7½ cu.ft. per linear foot. The attachment is a simple device which can be installed and taken off in short time in the field. It is driven by the same worm case which transmits power to the transverse screw of a spreading and leveling unit sometimes used behind the mixing machine. The attachment is taken off when the travel plant is working on small windrows, to save wear and tear on the belt and driving mechanism.

To facilitate handling of all sizes of windrows, up to and including 16 cu.ft. per linear foot, the self-propelled mixing machine is equipped with a transmission permitting travel speeds as low as 3 ft. per minute. By driving sprocket changes, a range of speeds from 3 ft. per minute to 84 ft. per minute may be obtained.

Monolithic Brick Pavement

(Continued from page 44)

depending on the air temperature and humidity. Bats of not less than ⅓ of a brick were used at the center joint and one curb to obtain closure. The Flexible Road Joint Machine Co.'s new brick vibrating machine then was used to embed the brick firmly in the plastic concrete base and remove surface irregularities. This machine consisted of a series of 12-in. shallow heavy-duty channels 60 in. long, mounted at right angles on a steel beam spanning the roadway and suspended from a carrier frame propeller by a gas-electric power unit. It weighed 14,800 lb. and was self-propelled in both directions.

When in operation the suspended assembly rested on the brick surface and could be adjusted to fit whatever crown was desired in the pavement. The assembly was vibrated by means of four electric vibrators operating at frequencies of 3,600 r.p.m. mounted on the transverse member and slid over the brick surface as the carrier moved

(Continued on page 90)

LABORATORY TESTED

...which means that Macwhyte Wire Ropes, when given a "final OK" by the laboratory, are ready for dependable, economical service.

FIELD PROVED

...on all kinds of jobs, on all kinds of equipment, under all kinds of conditions. All year long, Macwhyte Engineers on the *job*, are constantly proving, improving, perfecting the *right* wire rope for *your* specific job.

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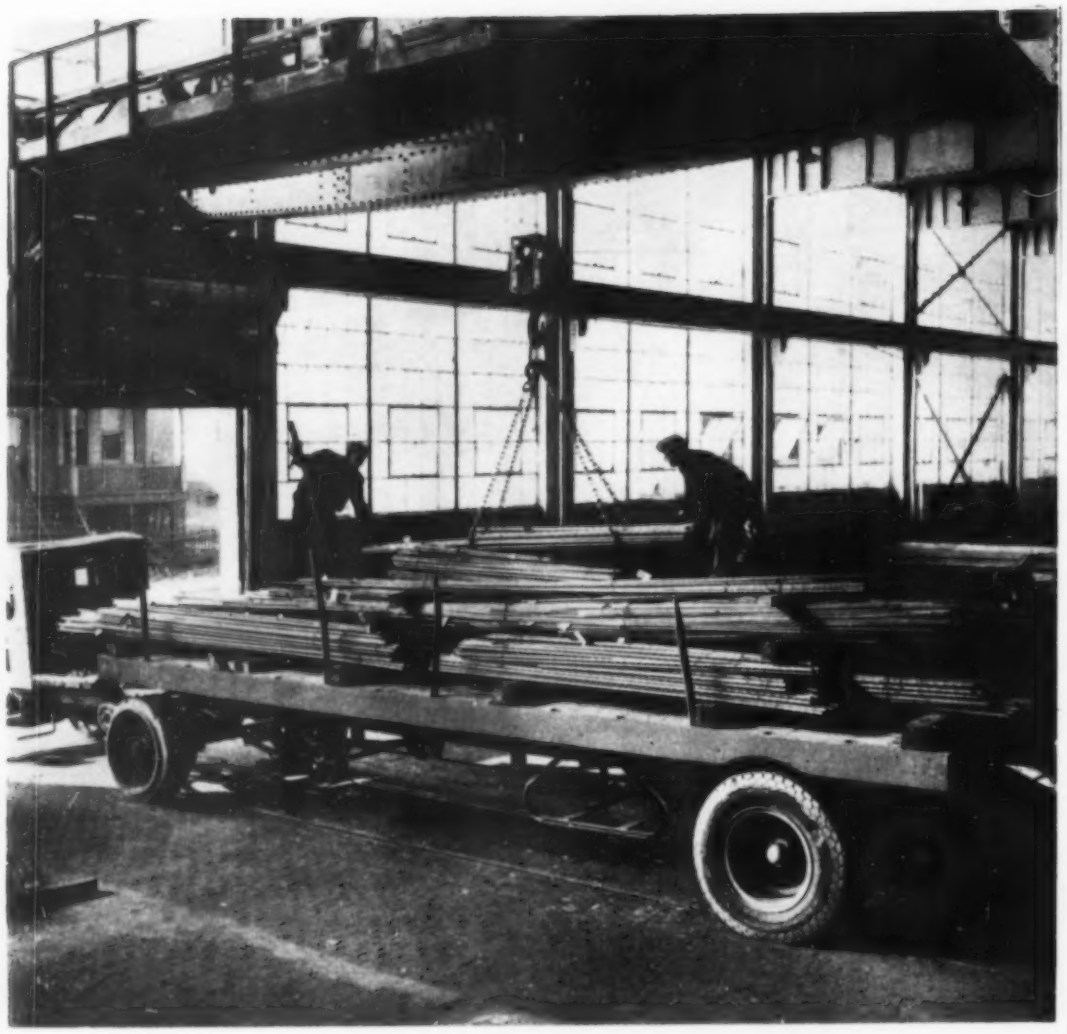
WIRE ROPE

MACWHYTE COMPANY · KENOSHA, WISCONSIN · Manufacturers of wire rope and braided wire rope slings . . New York . . Pittsburgh . . Chicago . . Ft. Worth . . Portland . . . Seattle . . San Francisco . . (Distributors throughout the U. S. A.)



Get Bethlehem Reinforcing Bars *from well stocked warehouses* in Key Cities

No matter where you're located you get dependable service on reinforcing bar orders from Bethlehem warehouses. They are large, generously stocked at all times, and situated right where you need them—in key cities serving major construction areas.

Call Bethlehem on your next bar order. Our shipping set-up is ready to serve you with efficient personnel, with main-line rail and water outlets, with a fleet of powerful trucks. We'll do our part to place urgently wanted material on the job when you need it.

BETHLEHEM STEEL COMPANY

(Continued from page 88)

in either direction on the steel forms. Generally one pass of the brick vibrator was sufficient to embed the brick firmly in the plastic concrete base and remove surface irregularities. Culling was carried on ahead of the vibrator and it was found that no breakage resulted from use of this machine.

The settlement of the brick into the concrete as a result of the vibration was from 1/16 to ⅛ in., with an occasional measurement of ¼ in. being recorded. This resulted in from ¼ to ⅓ in. of mortar being forced up into the joints between the brick from the bottom.

The cement grout filling operation was likewise mechanized. A 1-bag mixer mounted on an old finishing machine carrier and equipped with chutes for depositing the grout anywhere within a 10-ft. radius in back of the machine was constructed by the contractor and used successfully. The mixer was charged with sacked sand and sacked cement carried to it on a wooden runway; the proportions were 1:2 by volume. The machine was self-propelled with a power take-off from the gasoline engine which also operated the mixer.

When work was in progress the various operations presented an impressive train of equipment, and it was possible to complete slightly more than 600 lin.ft. of 20-ft. width monolith brick pavement in a day, in which no single operation required over eight hours work. The completed pavement presented a pleasing appearance and the advantages of a rigid type pavement with a vitrified brick wearing surface.

The brick were furnished by the Metropolitan Paving Brick Co., of Canton, Ohio, and credit for the idea of using mechanical vibration on brick surface construction must also be given to them. The Elmer O. Vogt Construction Co., of Massillon, was the contractor on this project which was done under the direction of the Ohio Department of Highways with Federal Aid. A. E. Ranney was division engineer of the district in which the job was located. W. K. Belknap, resident engineer for Stark County and L. I. Luke, project engineer were in direct charge of the construction.

Tamping Finisher

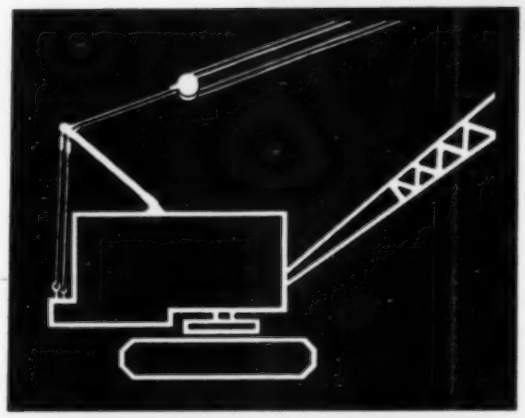
(Continued from page 57)

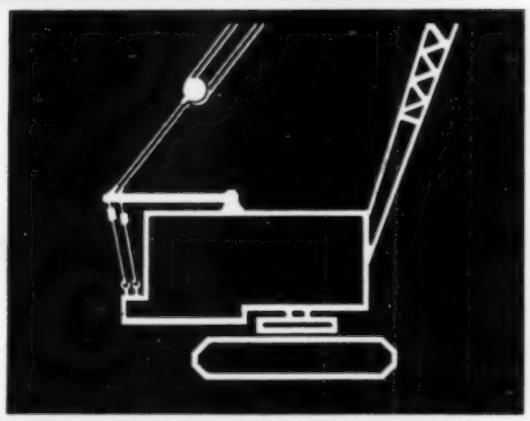
surface irregularity except for an occasional slight difference of levels at transverse joints, quickly ironed out by hand. The job included a large number of manholes, one intersection alone having fifteen. At such places, the finisher was set to skim over the tops of the manholes, leaving a thin shell of asphalt which was easily removed after the machine had passed. No difficulty was encountered in maintaining a 1-in. compacted thickness of sheet asphalt with the finisher.

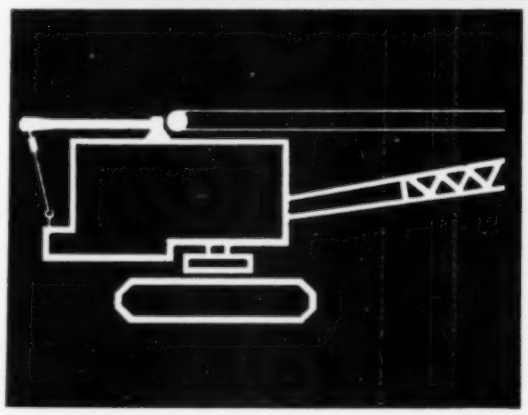
To charge the hopper of the finisher, a loaded truck backed up to the machine until the rear tires came in contact with a roller at the forward end of the hopper. The truck driver then threw out his clutch, and the finisher moved the truck while the latter dumped its load into the hopper, auto-

(Continued on page 92)

THE EXCLUSIVE RETRACTABLE MAST FEATURE







THE AMERICAN GOPHER CRANE SHOWN ERECTING OIL REFINERY STEEL HAS A 75 FOOT BOOM AND A 20 FOOT GOOSENECK BOOM EXTENSION.

STREAMLINED STEEL ERECTION

WITH THE MODEL 500 AMERICAN GOPHER 30-TON CRANE WITH GOOSENECK BOOM EXTENSION AND RETRACTABLE MAST

Superior Strength, Reach and Accuracy of Load Placement, plus the flexible clearance of the Retractable Mast make the AMERICAN GOPHER Model 500 the most productive and adaptable tool available for factory and refinery erection work. Deck and load turn smoothly — under hair-line control — on an enclosed roller bearing six feet in diameter.

Tipping strains are diffused around the 21-foot bullgear by Interlocking Gib Rings.

AMERICAN Improved Air Control is more responsive, simpler, not affected by changes of temperature.

Write Dept. CM for Bulletin 700-G-11.

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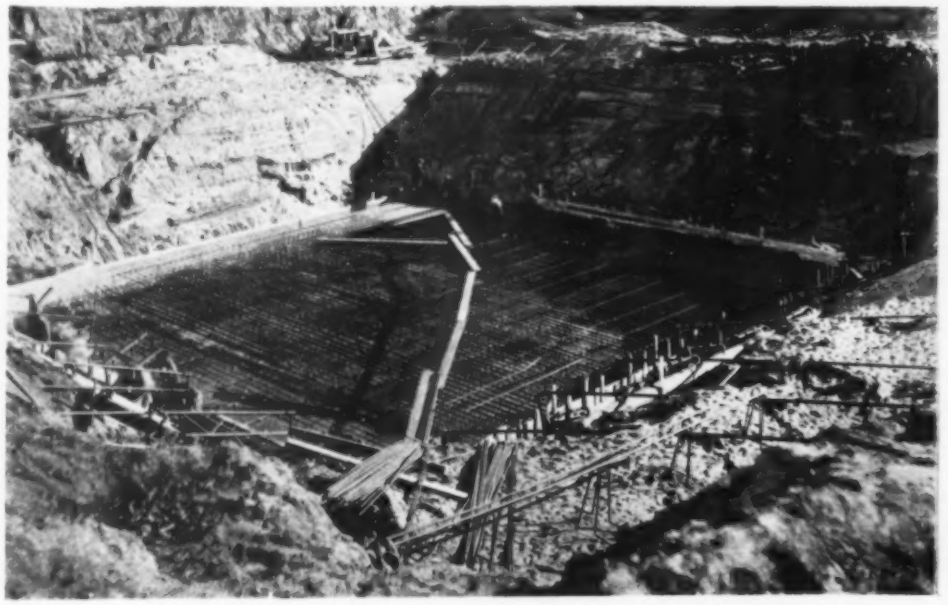
THE SAFE FASTENING FOR WIRE ROPE



Predrain with Moretrench!

IT'S THE *SUREST* WAY TO SAVE TIME AND MONEY ON ANY WET JOB.

MORETRENCH CORPORATION 90 West Street New York City

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GORMAN-RUPP PUMPS UNSURPASSED FOR PRIMING FAST

AT CAPE COD CANAL

Three 8-inch G & R self-priming centrifugal pumps make play of draining muddy water on Cape Cod Canal project at Boston.

MUDDY WATER IS THEIR DISH —24 HOURS A DAY!

You can bank on it—G & R pumps WILL NOT CLOG—they ASK NO TIME OUT. Let G & R Pumps tell their own story on the job. They will deliver as much (often more) water under any conditions than any other pump. We will ship you one and let you be the judge.

PROMPT DELIVERY ... from Stock in 100 Principal Cities

THE MOST DEPENDABLE PUMPS FOR THE LEAST MONEY

WRITE

THE GORMAN-RUPP CO., Mansfield, Ohio

Maybe you're up against a different kind of tension problem, but whatever it is there's one thing sure — if there's a load on a line the Martin-Decker Tension Indicator will quickly and accurately tell you exactly what that load is, *without paper calculations and without dead-ending!* Just clamp it on the line and read the dial — you *know* what the load is, because *you actually measure it as it falls on the line!*

Martin-Decker Tension Indicators are available in three sizes for use on lines from 3/16" to 2¼" diameter. All sizes are adjustable for temperature changes. Write for Full Information

MARTIN-DECKER CORPORATION

LONG BEACH CALIFORNIA

San Joaquin Valley Distributor A. F. McQUISTON, Bakersfield, California

Mid-Continent Distributor REED ROLLER BIT COMPANY, Houston, Texas

(Continued from page 90)

matically synchronizing the truck and finisher as a unit during the dumping operation. At the bottom of the hopper was a pair of independently operated flight conveyors, one on each side, which delivered the material back into two independently operated spreading screw conveyors. This mechanism facilitated control by the operator and assured proper distribution of material to the vibrating tamper and to curb strips.

Progress — Resurfacing of the entire area was completed in about five working days. Certain blocks were completed as units to reduce delays in opening them to traffic, even though it would have been more economical to allow the machine to continue straight through block after block on each lane. As soon as the contractor had completed brooming in the stone dust over the top course, the City Street Department applied traffic lane markers, painting them by machine in one block while the finisher was working on the block ahead.

Direction — H. E. Mundhenke was city engineer in charge of the work for Rockford, Ill. The city employed the Flood Laboratories, of Chicago, as inspectors on the job. For the Geneva Construction Co., contractor, Aurora, Ill., operations were directed by W. H. Hogan, superintendent, and P. W. Logan, street foreman, under the general supervision of Gil Bryan, president.

BLUE RIDGE PARKWAY

(Continued from page 47)

types of drilling equipment is employed, depending on conditions. Contractors have found that it does not pay to use partially suitable equipment that they may have. The jobs have been of such magnitude and the hard rock encountered so difficult that in nearly all cases it has been found desirable to employ the most efficient compressor and drilling units available.

In heavier cuts wagon drills have proved the most efficient under the conditions presented. They are used as the mainstay for such work, with portable drills of moderate sizes for the local holes and for breaking up oversize rock loosened by the big shots.

Common practice on the project is to handle pieces of rock much larger than usual with the power shovels. This practice is made possible by the large bodies of the dump wagons, reducing materially the amount of secondary drilling and shooting that are necessary.

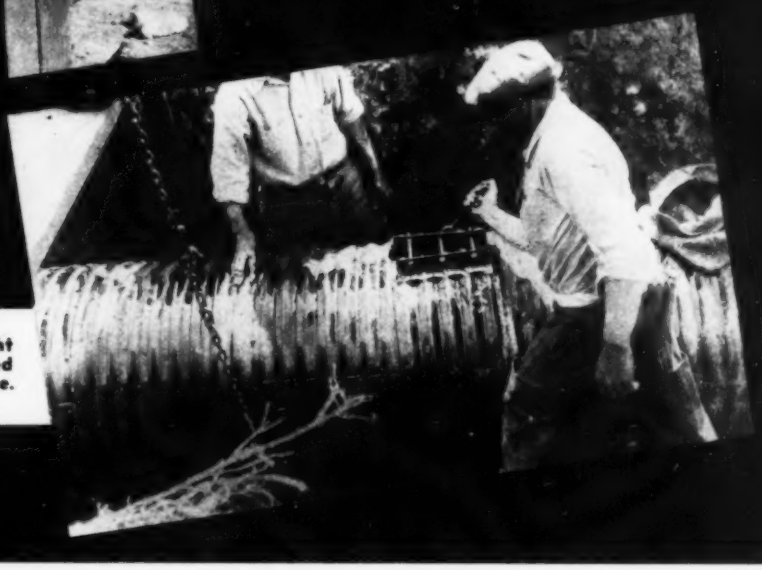
Almost without exception, the contractors on the heavier rock sections are using replaceable drill bits. Experience on the isolated work, where movement along the pioneer roads is often difficult and expensive, has shown that this type of bit is specially suited to the conditions.

Oil and Fuel — Consumption of fuel and lubricating oils on all of these projects is a large item of the total cost of supplies. Utilizing the excellent organization of the principal oil companies operating in the territory, deliveries are made to the different jobs by their local distributors whenever required. This feature of service eliminates any

(Continued on page 94)

YOU PROFIT 6 WAYS with ARMCO PIPE

Ropes and plank skids are the only equipment needed to lower Armco pipe into the trench, saving up to 80% in handling.



Unskilled workers can make strong tight joints in a few minutes with Armco bolted couplings. Cold weather is no hindrance.

1. FEWER TONS TO HANDLE

Any able contractor can make a good profit installing Armco pipe because it is 7 to 10 times lighter than massive rigid types. This helps reduce hauling and handling costs, eliminates the need for heavy machinery, and assures greater safety for workmen.

2. SAVES ON EXCAVATION

There's less earth to move because Armco pipe takes a narrower trench due to its lighter wall thickness. It also saves hours of extra digging required for bell or mortared joints.

3. CUTS FOUNDATION COSTS

Just lay Armco corrugated pipe on a uniform foundation and connect the individual sections. No special bedding, cradle or piling is needed to assure accurate grade and alignment.

4. ELIMINATES BREAKAGE

With flexible Armco pipe there's no time lost replacing broken or chipped sections. Moreover, there's less risk of damage from sudden cloudbursts that may occur without warning.

5. SPEEDS WORK

Because it is easily handled in 20-foot lengths, Armco pipe saves up to 1056 joints a mile. Even in sub-zero weather strong, tight connections can be made in a few minutes by unskilled labor. No heating or special protection is needed.

6. REDUCES OVERHEAD

You're always "ahead of the job" with Armco pipe because you can install it in a hurry, backfill it immediately, and keep your equipment moving on schedule without costly delays.

Before you bid on that next drainage or sewer job let an Armco man show you how much you can save with Armco pipe. Just address Armco Culvert Mfrs. Assn., Middletown, Ohio

ARMCO CORRUGATED METAL PIPE

PLAIN GALVANIZED OR BITUMINOUS PAVED AND COATED

Selling Construction Service — Dingman
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Practical facts on every phase of building construction!

HERE is a Library of books that are packed to the covers with the best plans and methods for speeding up production, saving materials and labor, and cutting costs. These six books cover every phase of practical construction work from estimating building costs to the selling of construction service — from plan reading and quantity surveying to practical job management. With the aid of these books the contractor can get business in these dull times by learning how to make savings, and through them being able to make lower bids. The construction superintendent can learn how to keep costs down, which insures his job these days.

The Dingman Building Contractors' Library

This library is intended for —

[1] The building contractor who wants a handy reference set that will give him almost instantly a ready answer to most of the problems that come up in the course of the day's work.

[2] The young men in the building industry who intend to make the business of construction their life work, and who want the kind of guidance that will aid them to climb to the top.

[3] Everyone in the building industry who wants to keep his job by increasing his usefulness and efficiency.

Each one of the volumes in this set is a complete handbook on some important subject. Sturdily bound and pocket size, it will go right "on the job" with you for immediate consultation.

Practical data is given on analyzing a construction job into its component parts — estimating the costs of labor, haulage, equipment, materials, etc. — plan reading and determining quantities from specifications — personnel management — successful supervision of every building operation — efficient and economical business methods — office procedure such as accounting banking, purchasing, etc. — advertising and selling methods for contracting service — and a complete data book of tables, forms and calculations most frequently used by the builder.

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Without a cent of expense — without any obligation on your part — you may examine the Dingman Building Contractors' Library for 10 days and determine its value for yourself. Try the books out on your everyday problems — make them prove their worth to you. Unless they meet every test send them back at our expense. If the books prove satisfactory and you decide to keep them, pay only $1.50 in ten days and then $2.00 a month for six months.

[*Every contractor and builder, every architect and engineer, every student and executive, who is seeking practical help on the everyday problems connected with building construction work should have this valuable reference library.*]

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CM-2-39

(Continued from page 92)

need for the contractors to maintain their own storage or to do any hauling of oil supplies.

Supervision — The Blue Ridge Parkway, which is estimated to cost around $16,000,000, is being built under the supervision of the National Park Service and will be operated by that organization, with Stanley W. Abbott as acting superintendent of the project.

All highway engineering on the project has been done by the U. S. Bureau of Public Roads, which also has charge of construction. H. J. Spelman is district engineer in general charge of the undertaking. S. L. von Gemmingen is in direct charge of sections in North Carolina on which particularly heavy work is in progress.

EMPLOYEE RELATIONS

(Continued from page 63)

be allocated by local employment offices prohibits the moving of unskilled labor from job to job, except in a very limited area, so the early custom of establishing commissaries upon each job and of moving unskilled labor from job to job has very nearly disappeared, at least in the East. Improved facilities of transportation, of course, do not make that practice as necessary as it once was.

Under existing conditions a complete turnover in unskilled labor is compulsory for any organization moving from one zone of employment to another. This condition makes it difficult for the employee to start at the bottom rung of the ladder in an organization and to climb upward by virtue of his efforts. He has first to obtain recognition for some outstanding talent and be raised to the skilled classification before he achieves a position with the possibility of permanence, due to the customary short stay in his locality of the organization with which he affiliated and to his inability to move outside of his employment district as an unskilled laborer. Under existing conditions of local employment it will never be known how many employees classed as unskilled fail, by close margins, to obtain ratings which would permit them to move with organizations leaving their employment districts.

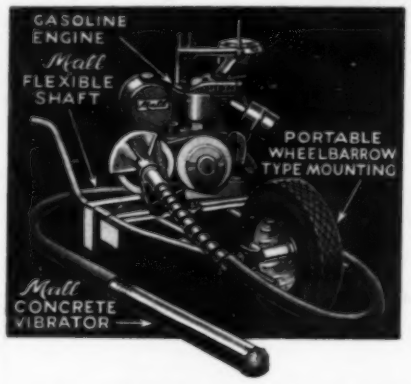
It is to be expected that in time the need for restriction in the area in which the unskilled employee may work will disappear, which will remove this obstacle to starting at the very bottom and working up. In years past many thousands of young, ambitious men have taken work in unskilled capacities with road building organizations and have developed talents they little suspected they possessed, with the result that they came to occupy positions of responsibility. The numbers of farm boys who have developed latent mechanical skill in the highway construction field and who now occupy key positions in the writer's organization is surprising.

Promotion from Ranks

The plan of maintaining reasonably stable organizations offering opportunity for advancement of employees is, of course, possible only provided

(Continued on page 96)

MAKE BIGGER PROFITS with *Mall* VIBRATORS



MALL concrete vibrator powered with gas engine. Attachments can be furnished for SURFACING, DRILLING, SAWING, PUMPING and SANDING. A multi-purpose machine!

They are earning hundreds of dollars for contractors everywhere. MALL vibrators eliminate honeycombs and expensive patching, save labor and material, and produce strong, durable concrete. There is a type and size — gas engine, air, or electric — 5000, 7000 or 10,000 r.p.m. — for each specific concrete job.

Our engineers will gladly help you select the MALL best suited for your work. No cost or obligation!

Mall Tool Company

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COFFING SAFETY PULL RATCHET LEVER HOISTS

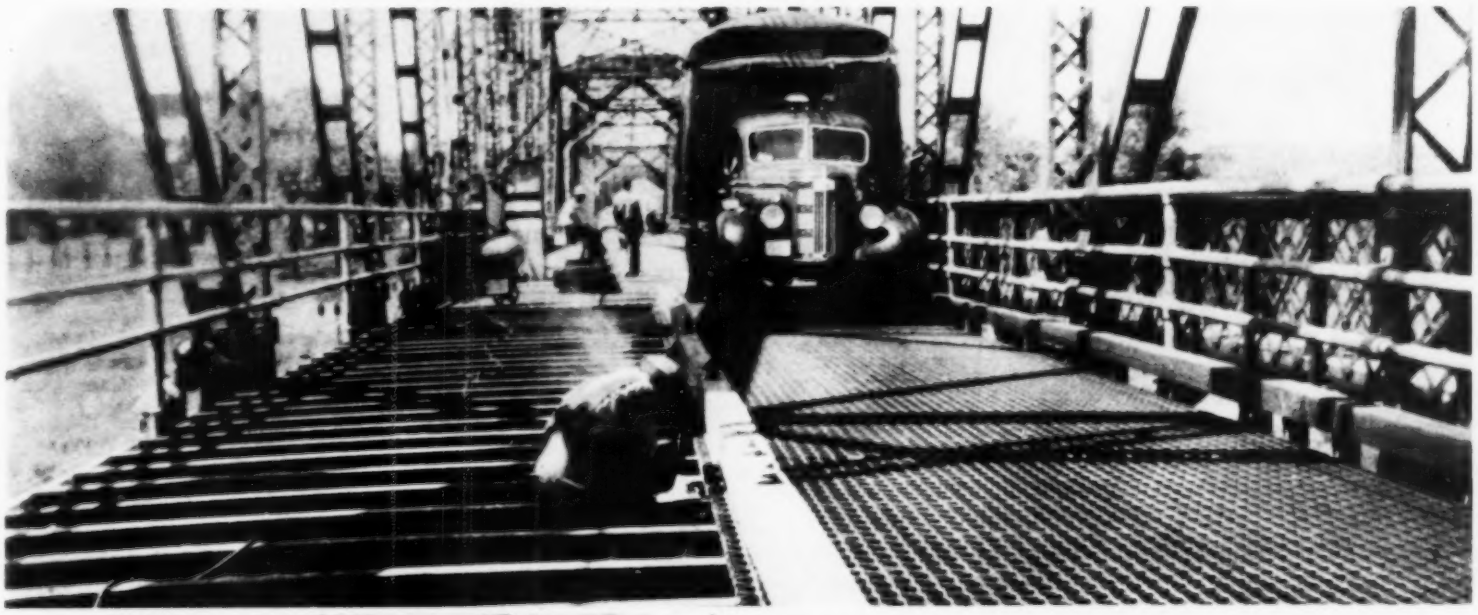
...SAVES TIME LOSSES FOR LIFTING AND PULLING JOBS

No need to take a number of men from their jobs, thereby losing valuable time, to do a lifting or pulling job. One man and a Coffing Safety-Pull Ratchet Lever Hoist will do the lifting and pulling jobs better, quicker, and safer. It makes possible tremendous savings because of high quality, speed, safety features, and all around efficiency. Its uses are unlimited.

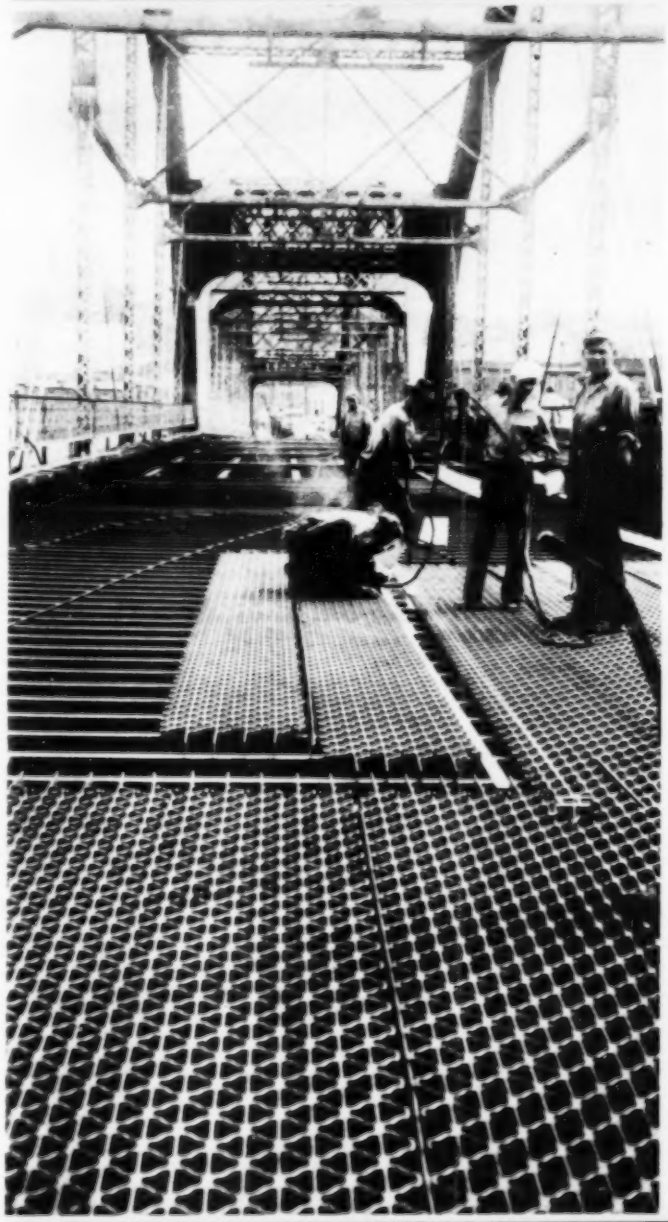
The safety-pull ratchet lever hoists are designed to meet the demand for heavy capacity hoists that can be easily operated and transported on the job. The range of sizes and capacities gives you a wide choice for your particular need—from ¾-ton cap. which weighs 14 lbs. to 15-ton cap. weighing 150 lbs. You will be repaid a hundred-fold in time, money, and labor because the initial cost is small, smaller than for conventional hoists of the same capacities. There is no substitute for Coffing Hoists in construction work—let us convince you. Write today.

COFFING Advanced Design HOISTS SPUR GEAR RATCHET LEVER ELECTRIC

COFFING HOIST COMPANY
DANVILLE, ILLINOIS



↑ **IN MISSOURI.** *New I-beams were welded to the stringers of this old highway bridge, and the old floor of an asphalt base was replaced with new steel grid flooring by Lincoln "Shield-Arc" Welders and "Fleetweld" Electrodes. Work done by Reliance Steel Products Co., McKeesport, Pa.*



TWO MORE BRIDGES REJUVENATED BY "SHIELD-ARC" WELDING

HERE are two bridge reconditioning jobs typical of hundreds in which Lincoln *"Shield-Arc"* welding has made possible outstanding economies.

With new steel added to the beams and stringers, and with the old flooring replaced by a new grid steel flooring, these two bridges were reconditioned at a minimum cost and made better than when new because:

They can carry increased live loads because of the added strength and reduced dead weight.

Their grid type flooring drains off water and snow and provides a skid-proof surface in all kinds of weather.

Maintenance cost on the new flooring will be a fraction of that required for the old.

Bridge reclamation is only one of the many profitable uses for Lincoln *"Shield-Arc"* welding in construction work. For valuable suggestions, consult the nearest Lincoln office or mail the coupon.

← **IN PENNSYLVANIA.** *New 8" channels were welded crossways on the old bridge stringers and the wood block floor was replaced with a new grid steel flooring by Lincoln "Shield-Arc" Welders and "Fleetweld" Electrodes. The new steel floor weighs half as much as the old wood floor, enabling the engineers to increase the live load of the bridge from an H-15 to an H-20 loading. Work done by Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.*

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LINCOLN

THE LINCOLN ELECTRIC COMPANY
Dept. G-564, Cleveland, Ohio

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☐ Welding Procedure Guide.

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P 85

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Lower the Cost of Handling Cement from Car to Paver Thru' The Heltzel Model E-1 PORTABLE BULK CEMENT PLANT.

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WARREN, OHIO — U.S.A.

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CEMENT BINS Portable and Stationary
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BATCHERS (for batch trucks or truck mixers with automatic dial or beam scale)
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CURB FORMS
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SIDEWALK FORMS
SEWER AND TUNNEL FORMS
CONCRETE BUCKETS
SUBGRADE TESTERS
SUBGRADE PLANERS
TOOL BOXES
FINISHING TOOLS FOR CONCRETE ROADS

The HELTZEL "Heavy Duty" CONCRETE BUCKET

Positive Center-Line Discharge Control

"Grout-Proof"

Bulletin U-29-B

PROGRESS WITH HELTZEL EQUIPMENT

(Continued from page 94)

the employer is alert to recognize ability in members of his organization and to grant promotions where they are in order, Too frequent hiring of individuals new to an outfit for positions of responsibility is bound to discourage those of the organization who, by virtue of their experience, are in line for the positions. Promotion from the ranks is, perhaps, the most effective incentive to efficiency on the part of employees and is the feature most productive of loyalty. In the writer's opinion there is no doubt that employees, as a whole, favor the plan of steady work with organizations known to offer opportunity for advancement, as compared with the plan of rendering their services to new employers at frequent intervals. The feeling that one is among friends, rather than among strangers, is not a minor factor in promoting happiness and a sense of security.

The highway contractor operating only in the North is faced by an insurmountable obstacle to the carrying on of his work during twelve months of each year. Weather conditions during the winter months prohibit the carrying on of all but very few of the separate operations of road building, such, for instance, as heavy grading. It is inevitable, therefore, that a large proportion of employees in the highway construction field are faced by lack of employment for a period of each year.

It is possible, however, for the employer to reduce somewhat the hardship of idleness enforced by seasonal restriction in construction activity. The training of members of his own organization in the work of overhauling heavy equipment during the season of construction inactivity affords opportunity for employment for a considerable percentage of his skilled employees. Surely this plan is to be preferred to the plan of having the overhauling done in shops not under the control of the employer and manned by forces other than his own.

Bonus Payments

Enforced idleness upon the part of a large percentage of highway employees during the winter months logically opens for discussion the plan of bonuses paid by the employer as additions to wages and salaries. Payment of such bonuses at the beginning of the period of enforced idleness, which incidentally is approximately at the Christmas season, greatly eases the burden of unemployment and plays no little part in promoting *esprit de corps* throughout the organization. The employee who receives such a bonus cannot but feel that his services are appreciated by his employer and that his efforts have played a part in the business success which has made the payment of his bonus a possibility. Whether bonuses should be figured on the basis of definite percentages of the individuals' earnings for the season or whether attempt should be made to recognize individual ability and energy may be debatable. It is believed, however, that any bonus paid should constitute in some degree a reward for merit.

Few concerns, no doubt, find it possible to pay bonuses to employees every year without exception. Bonuses are paid from earnings of the business, and if earnings are absent, the payment of bonuses, of course, is impossible. However, if a concern adopts as its policy the payment of bonuses when possible, the employee recognizes as inevitable the omission of bonuses when the earnings do not permit of it. For many years it has been the practice

(Continued on page 98)

GALION

THE NATIONAL FAVORITE

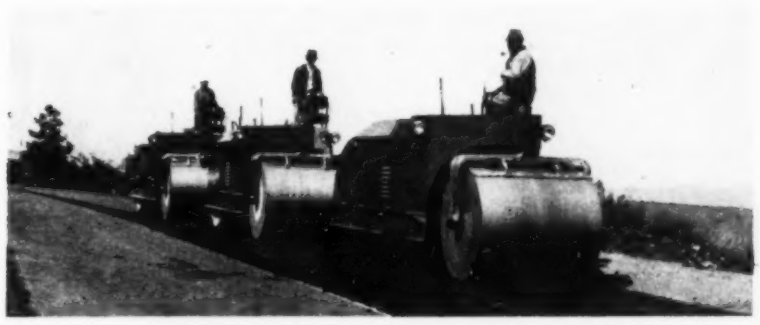
Above — one of three Galion pull type graders with pneumatic tires being used by Mesa County, Colorado, in their ditching and maintenance program mostly on dirt roads.

Virginia, Colorado, Oregon or wherever you may go . . . you'll invariably find one or more Galion road building and maintenance units on the job, providing genuine utility and low cost operation for some progressive owner.

For instance, one of the three Galions owned by Mesa County, Colorado, is shown in the large photo above. These graders are being used for dressing up and maintaining county (mostly dirt) roads. 25 to 30 miles of road are maintained in one day with these efficient machines. Up to 10 miles per day on ditching work, depending upon conditions.

Galion graders and rollers will mean profit and finer work for you because Galion combines the long, dependable life of heavy equipment and the economy and ease of operation of light equipment. Constant development and improvement make the Galion line the National favorite. Let us tell you more about it. Write today.

The Galion master model motor grader shown above is spreading stone on this Oregon State highway. It is equipped with diesel engine, hydraulic control and double drive. A Galion 3-wheel roller follows through after material is spread.



Four tandem rollers are being used on the Skyline Drive through Virginia to compact surfacing material. Three of these reliable variable weight units are pictured.

The Galion Iron Works & Mfg. Co.

Main Office and Works: **Galion, Ohio**
Export Division: **Columbus, Ohio**

Motor graders
Pull graders
Maintainers
Spreaders
Sanders

GALION ROAD MACHINERY
points to better roads

3-wheel rollers
Tandem rollers
Portable rollers
Trench rollers
Rooters

—because it's a UNIVERSAL!

This compact gravel plant for straight line operation is making money for its owner, an Iowa contractor. It crushes, screens and loads; material passing through in a smooth, steady stream, keeping the dragline and the operator's trucks on the go all the time.

And Universals do it at the lowest operating cost and with a minimum of repairs, allowing their owners to operate at a profit on every job as Universal Crushers and Crushing Plants always do—because they've got the "guts" to stand up and grind it out even under the most constant use and even the most hard-to-crush materials.

Why can Universals crush greater capacities, faster, more uniformly and at a lower cost? Superior design, improved construction, longer lasting materials that result from a third of a century of engineering experience.

Universal has built crushing equipment exclusively since 1906. Over 50 combinations of Portable, Semi-portable and Stationary Crushing, Screening, Loading and Washing Plants are available today—each the most profitable and productive of its type in the field.

You can bank on a Universal! Write for new literature.

UNIVERSAL CRUSHER COMPANY
327 Eighth Ave., West,
Cedar Rapids, Iowa

UNIVERSAL

(Continued from page 96)

of the writer's concern to pay bonuses at the close of each season when earnings made it possible. Instead of encountering resentment upon the part of employees over non-payment of bonuses when conditions prohibited such payments, the writer has been gratified to note sincere feelings of regret that the season's business was not successful. This would appear to prove that a spirit of friendliness and cooperation between employee and employer is not impossible of accomplishment.

Human Relations

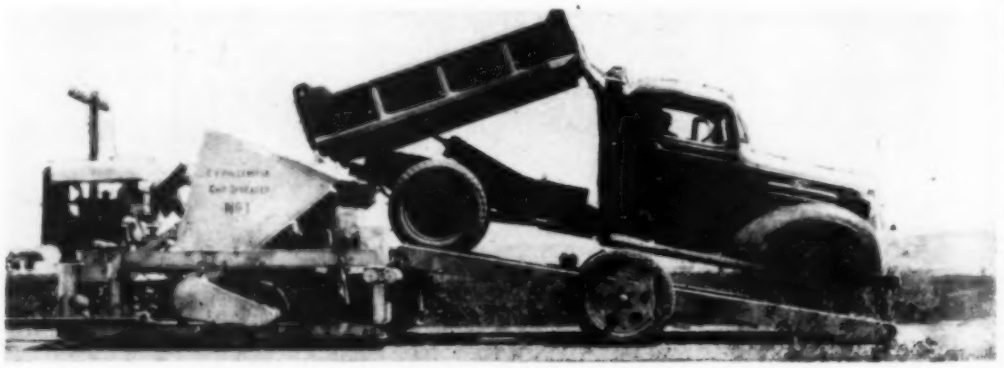
The entire problem of relations between employer and employee in its fundamentals is merely a problem in the great study of human relations. Perhaps in the development of our great industries we have become too impersonal in our viewpoints. Surely we have progressed far beyond the period during which the successful employer sought out and coddled all of newly born among the families of his employees. However, we must bear in mind that man is not a machine; that he has the right to expect to live in a manner in keeping with his fellows, that he and his family may enjoy to the full the privileges and the comforts common to the community and nation in which he lives.

Closer contact between employer and employee may be the solution to many of the problems which demand solution today. We in the United States have much to be thankful for and in no small degree is this due to the success of the American system in industry. In our attempt to remedy the ills which temporarily beset us, let us study that system intensively to the end that it may be improved and perpetuated, rather than be thrown into the discard in favor of untried systems.

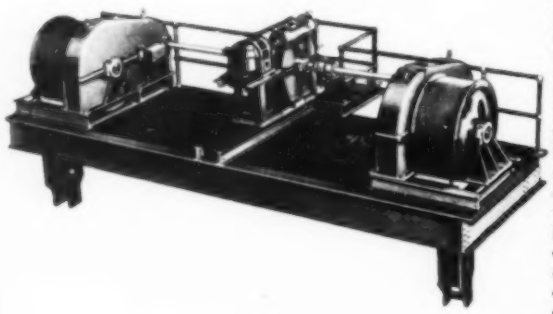
CONSTRUCTION EQUIPMENT NEWS

(ALL RIGHTS RESERVED)

Review of Construction Machinery and Materials for FEBRUARY, 1939



ROAD SURFACING MATERIAL SPREADER, known as "Chip-Top Spreaderoller," for seal coating and spreading all types of stabilized road materials, segregates aggregates into coarse and medium-sized material and fines, deposits them in that order on freshly sprayed bituminous surface and rolls them smooth, all in one operation. Consists of chassis mounted on three rollers, third of which is at back of machine directly behind inside edges of two forward rollers. Front rollers are driven and machine is steered by braking either right or left driven roller. Mounted on chassis is industrial power unit and hopper with mechanical distributor which feeds aggregates to shaker screen. Roads seal-coated with this machine are said to be highly skid-proof and light in color, making them visible at night and in foggy weather.—**Universal Crusher Co., Cedar Rapids, Ia.**



GATE HOIST is one of heavy motorized units used to raise and lower large gates on huge power dam now being completed on Flathead Lake near Polson, Mont., for Rocky Mountain Power Co. When dam is ready for service, gates will be raised to hold level of water for considerable period at or near 2,893 ft., normal high water mark. When gates are down elevation of dam is 2,870 ft. Crest of dam is 23 ft. lower than normal high water mark and 13 ft. below normal low water mark, thus affording ample accommodation for an unimpeded run-off during flood season. New dam adds about 20 per cent to installed capacity of state's largest hydro-electric enterprise.—**D. J. Murray Mfg. Co., Wausau, Wis.**

OUTPULLS
ANY TRUCK ON WHEELS!

TEN NEW GMC 2-CYCLE DIESEL TRUCKS— bring Diesel economy within reach of all medium and heavy-duty truck operators! GMC Diesels are smaller, lighter and smoother in operation—and easy to understand, to drive and to service!

General Motors Trucks outpull all others because the new GMC SUPER-DUTY engines develop more torque per cubic inch piston displacement. Thus, GMC trucks provide greater pulling power than other trucks of equal engine displacement and equivalent total gear reduction and tire size.

GMC's new POWER-PAK pistons and combustion chambers result not only in increased power but also in more efficient use of fuel! For the first time in truck engines, power has been stepped up and gas consumption definitely reduced—a combination that assures greater return on the dollar invested for every GMC truck user! . . . Better performance and economy with GMC's are provable by any test of your own driving!

Our own YMAC Time Payment Plan assures you of lowest available rates

THE TRUCK OF VALUE GMC

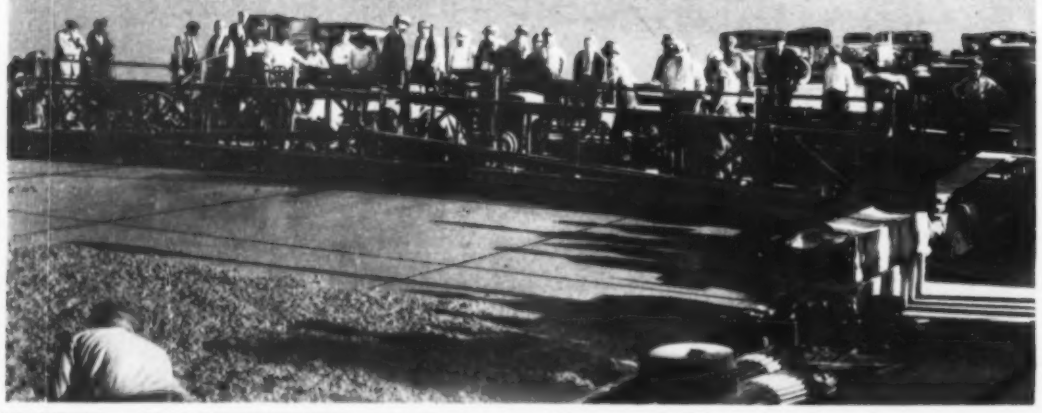
GMC TRUCKS
GMC TRAILERS • GMC DIESELS

GMC's RIDER-EASE CABS ARE *now larger than ever, feature scientific seat-positioning and rubberized hair pads for further comfort and offer better vision.*

EASY SHIFTING *Syncro-Mesh transmission and FRICTION-FREE ball bearing steering (available on medium and heavy-duty GMC's) greatly reduce driving effort.*

THIS is another big "FLEX-PLANE" finishing machine—a 50 "footer." The obliging operator backed the machine to show you the beautiful level surface produced by the famous "FLEX-PLANE" wide screed. The surface is not retouched.

FLEXIBLE ROAD JOINT MACHINE CO.
WARREN, OHIO



Everywhere you look, There's a HAISS Bucket!

They're on the big jobs—the hard jobs—the jobs where ONLY THE BEST IN BUCKETS can sell itself. The Haiss is TOPS today. Wire, write or phone for prices and catalogs.

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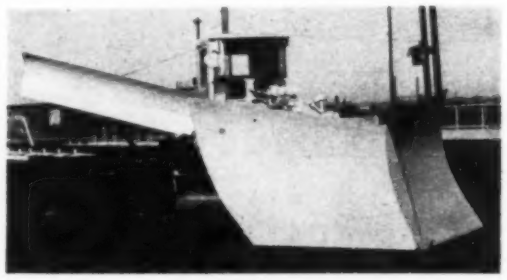
FOR PAY LOAD CLAMSHELL DIGGING

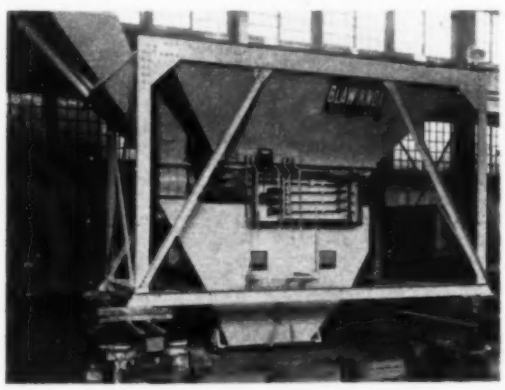
In stock at New York, Philadelphia, Baltimore, Atlanta, Hartford and Los Angeles
GEORGE HAISS MFG. CO., INC., 139th ST. & CANAL PLACE, NEW YORK—DISTRIBUTORS EVERYWHERE

LOW COST SNOW REMOVAL accomplished by Caterpillar diesel No. 12 auto patrol, having range of six forward speeds which adapt it to varying cold weather conditions. Top speed in excess of 15 m.p.h. sufficient for quick removal of light snow. Fifth



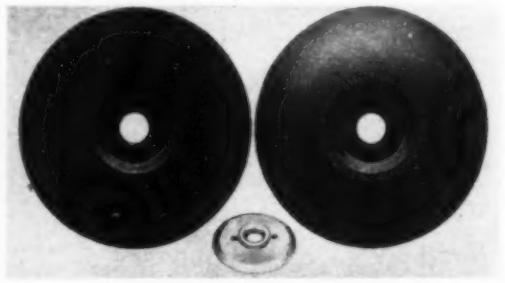
speed of 9.6 m.p.h. and fourth of 6.8 m.p.h. provide maximum speeds for ordinary snow work. Three lower speeds give extra push needed for heavy snows and drifts. For use with auto patrol, manufacturer offers V-type plow and mast-type snow wing with 12-ft. blade which extends delivery of deep snows far to one side, making it easier to handle additional snowfalls and providing for better drainage when thawing time comes. Power provided by 66-hp. engine located directly over axle drive, utilizing weight to best advantage for traction essential for maximum working capacity. Independent gasoline engine compactly mounted on diesel unit assures positive starting in coldest weather. — **Caterpillar Tractor Co., Peoria, Ill.**

COMPOSITE WEIGHING BATCHER, 2-cu.yd. capacity, for cement and three classes of aggregates, has recently been incorporated in a complete central mixing plant for the Penker Construction Co.,



contractor on Pennsylvania Ave. bridge project in Washington, D. C. Aggregate bin is three-compartment unit of 120-ton capacity, supplemented by auxiliary cement pocket of 15-bbl. capacity. Unique feature: All filling gates and discharge are mechanically interlocked, only one gate opening at a time; batcher discharge gate cannot be opened when a filling gate is open and vice versa. All five gate levers grouped closely together in front of batcher for convenience of operator. — **Blaw-Knox Co., Pittsburgh, Pa.**

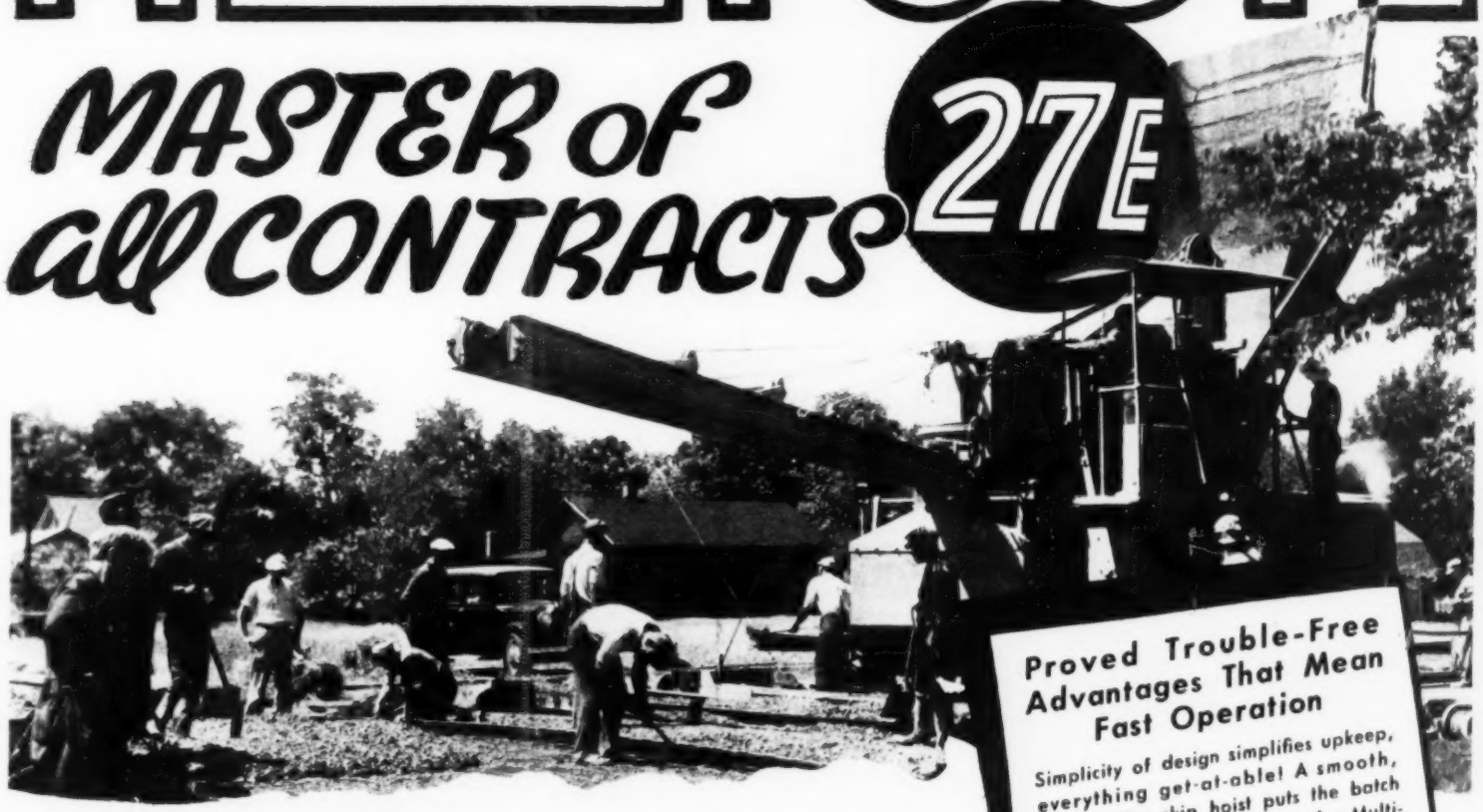
THREE-IN-ONE FLEXIBLE RUBBER SANDING PAD may be used for feather edging, flat sanding or leveling. One holder for all three sizes fits any United States sander. Sanding pad so formed that



when flat surface is applied it is ideal for sanding flat surfaces; when it is turned over and curved surface is applied, it is equally efficient in sanding curved surfaces and feather edging. Advantages: Affords perfect balance, longer life, greater flexibility, light weight, safety; non-breakable. Pad holder nut fits 5-, 7- and 9-in. pads. Pad is solid rubber without metal base which makes it flexible and enables it to reach places formerly finished by hand. —**United States Electrical Tool Co., Cincinnati, Ohio.**

MULTIFOOTE

MASTER of all CONTRACTS 27E



Proved Trouble-Free Advantages That Mean Fast Operation

Simplicity of design simplifies upkeep, everything get-at-able! A smooth, quick acting skip hoist puts the batch in the drum in a hurry—watch a Multi-Foote operate! Water is accurate to the drop, regardless of grade and it's unaffected by line pressure—a feature of the exclusive MultiFoote no-pressure water tank.

The Double Cone Drum assures a constant end to end motion—a thorough overlapping and scouring action that produces a better mix.

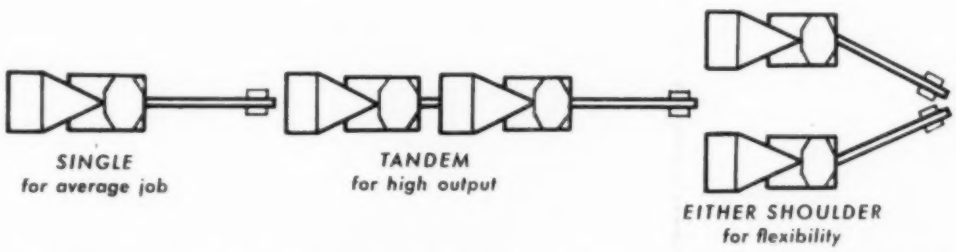
Discharge is fast—the bucket spreads quickly and easily and has more clearance beneath it—the boom has a wider radius and swings by power. It puts the puddle where you want it. These and many other features should warrant your investigation.

THE days of long mileages per job are gone. More than ever it is desirable to keep initial investment down. To meet the problem of bidding enough short jobs to make a profit requires a flexible plant set-up.

The MultiFoote 27E is geared to today's conditions. Operating in tandem, MultiFoote 27E pavers are capable of tremendous output, they will operate side by side on wide pavements, they can be operated from either or both shoulders, and you have a flexible machine set up that permits handling any contract problem that you may have to face without any readjustment of other equipment.

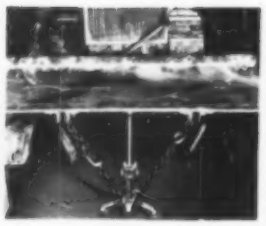
Investigate MultiFoote features.

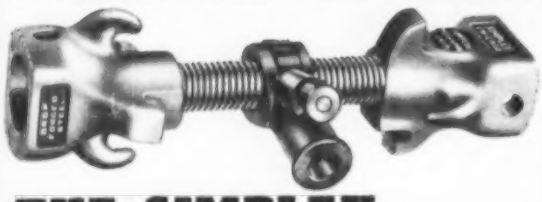
THE FOOTE CO., INC.
Nunda New York



27E GEARED TO TODAY'S JOBS

ADNUN BLACK TOP PAVERS AND ADNUN SPREADERS





THE SIMPLEX

"PUSH & PULL" JACK

DOES A THOUSAND JOBS FASTER —AND WITH LESS EFFORT!

Pushes, Pulls, Lifts, Spreads, Clamps and Ties; Pulls Gears, Wheels and Pulleys.

The handiest tool ever invented for use on construction jobs and heavy duty equipment maintenance. Thousands in service by thousands of enthusiastic owners.

Arrange to have your dealer make a demonstration for you. Send for Bulletin P-39.

TEMPLETON, KENLY & CO.
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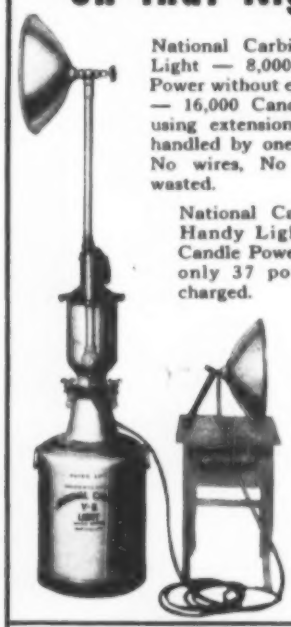
Better, Safer Construction Jacks Since 1899

SIMPLEX

Want Daytime Efficiency on that Night Job?



National Carbide V-G Light — 8,000 Candle Power without extension — 16,000 Candlepower using extension. Easily handled by one man — No wires, No carbide wasted.

National Carbide V-G Handy Light — 1500 Candle Power — weighs only 37 pounds fully charged.

National Carbide Lanterns — signal of red, blue or green — ideal for emergencies.

NATIONAL CARBIDE CORP.
LINCOLN BUILDING • NEW YORK

Send information on lanterns or V-G Lights with absolutely no obligations.

Name .....

Address .....

City ..... State .....

NEWS FROM MANUFACTURERS *About Their Products*

The publications reviewed below, will keep you posted on latest developments in construction equipment and materials available for your use.

HANDBOOK ON TIRES—**B. F. Goodrich Co.,** Akron, Ohio. (66 pp., 3¾x6½in., illustrated.) Includes table on effect of load and speed on commercial tire service, with percentages of recommended maximum loads at maximum sustained speeds to obtain normal tire service. Statistical material of interest to operators of trucks and tractors. Description and specifications of the company's products for these varied services are included. Four pages are given to a discussion of how to prevent truck tire failures, including the heat-speed problem. Development of the new Goodrich Hi-Flex tire cord, in which the cotton is processed so the cord is smaller in diameter than the ordinary type, and its relation to the heat-speed problem is related. Two pages are devoted to methods of correctly calculating truck tire costs, with a description of the company's new and improved truck tire calculator. This calculator can also be obtained upon request. Load analysis, load and service diagrams, load ratios and inflation pressures, and specifications for truck and bus tires, rims and dual spacings comprise six pages.

• • •

STEEL PIPE—**Republic Steel Corp.,** Cleveland, Ohio. (10-pp. folder.) "Facts About Republic Standard Pipe," contains bundling tables, sizes and weights, identification and corrosion information on standard pipe, copper-bearing steel pipe and Toncan copper molybdenum iron pipe. A convenient folder for pipe users.

• • •

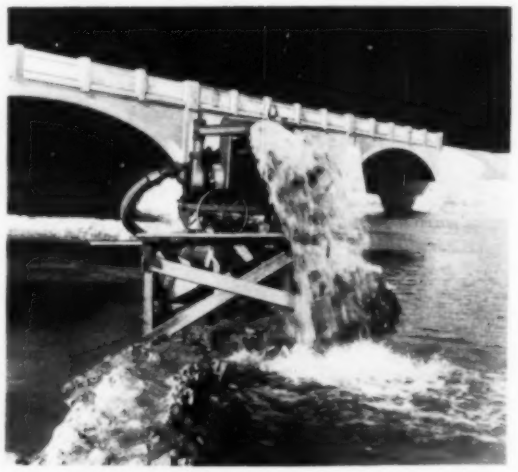
ALL-PURPOSE PLYWOOD—**M & M Woodworking Co.,** Portland, Ore. (Three folders, illustrated.) Wide uses for Resnprest, all-purpose, all-weather plywood bonded with phenol formaldehyde resin by the hot plate process. "Cut Modernizing Costs with Resnprest" demonstrates the adaptability of this low cost building material to modern, streamlined, rounded corner construction. Illustrated are a modern service station, grocery store and lumber yard, all constructed entirely of Resnprest. "Specifications and Instructions" folder diagrams four practical methods of installing Resnprest: (1) Flush wall, invisible joint; (2) modern, streamlined batten joints; (3) shiplap type joint; and (4) "lap and vee" joint. The folder also contains complete information on finishing Resnprest. "Enduring Signs of all Kinds" illustrates and describes new streamlined bulletins, outdoor cut-outs, road markers, real estate signs, etc. of Resnprest. All offer concrete evidence that Resnprest plywood will not separate even under severest weather conditions.

• • •

STEEL SHEETPILING—**Bethlehem Steel Co.,** Bethlehem, Pa. (24 pp., illustrated.) Catalog No. 151 contains useful information in the form of drawings and tabular matter on interlocking sheet steel piling, covering types, dimensions and properties of sections. Included, also, are details of standard fabricated corners, tees, crosses and other connections. Diagrams illustrate arrangements and dimensions of rectangular inclosures. Tables give lengths of walls formed with various numbers of piles, data for circular, cellular cofferdams, and allowable safe loads per linear foot of wall. Notes on driving arched-web sections in reversed position. General specifications covering material and driving. Two pages are devoted to H-bearing piles.

C.H.&E.

SELF-PRIMING PUMPS



- **PRIME FAST**
- **GIVE LARGE CAPACITY**
- **HANDLE MAXIMUM SOLIDS**
- **ARE DEPENDABLE**

Our new 16 Page Catalog will give you full details on all sizes 1½" to 8".

Also Saw Rigs, Hoists Rollers — a full line of construction equipment.

C. H. & E. MANUFACTURING CO.
3847 N. Palmer St. Milwaukee, Wis.

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NO MATTER— Where you move • How you move • or why you move . . . .

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CHANGE-OF-ADDRESS COUPON

CONSTRUCTION Methods and Equipment
330 W. 42nd Street, New York, N. Y.

Please change my mailing address

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CHANGE-OF-ADDRESS COUPON

It's "Happy Landings" for Union Metal Fluted Monotube Piles at North Beach Airport

2545 cast-in-place concrete piles installed in 45 days through use of Tapered Fluted Steel Monotubes

● Work on New York City's new $22,000,000 North Beach Airport is being rushed so that its opening will coincide with that of the World's Fair. Foundation contracts for the Administration Building and two hangars called for the installation of 2545 Monotube Piles in 45 days.

These 11-gauge steel piles, ranging in length from 16′ to 90′, were hoisted into position by a single snag line attached to the butt end and driven without core or mandrel. To reach the solid earth formation, it was necessary to pierce completely a strata of hard fill and, in doing so, a bearing of 75 tons was often developed although the design load was but 30 tons per pile. Despite this unusual condition, the Monotubes were driven, inspected, and filled with concrete within the 45-day limit.

Proof of the pile is in the driving. On this and scores of other jobs, these heavy-walled, cold-rolled Monotubes have given a convincing demonstration of their ability to save time and cut costs. If you would like complete facts concerning this modern method of installing cast-in-place concrete pile, write today for catalog No. 68 describing Fluted Steel Monotubes.

Visit Union Metal Exhibit at the San Francisco Road Show! Space No. C-10

THE UNION METAL MANUFACTURING CO., Canton, Ohio

WESTWARD HO!

EXHIBITORS LIST

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J. D. ADAMS COMPANY
AEROIL BURNER COMPANY, Inc.
ALLIS-CHALMERS MFG. CO.
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AMERICAN MANGANESE STEEL COMPANY
ANTHONY COMPANY, Inc.
ARMCO CULVERT MFRS. ASSN.
THE AUSTIN-WESTERN ROAD MACHINERY CO.
BARBER-GREENE COMPANY
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IOWA MANUFACTURING CO.

AMERICAN ROAD BUILDERS ASSN. · 1902 ·

SPECIAL TRAIN AND PLANE RATES TO SAN FRANCISCO WILL BE IN EFFECT.

FOR '39 HIGHWAY PROGRESS

The starting gun for tomorrow's highway construction will be fired in San Francisco's Civic Auditorium. Problems will be solved, plans will be made, ideas will be born!

Brand-new equipment to provide better and safer roads for the highway user and increased prosperity for the highway builder will be on display.

Convention sessions will present a program of profit for the county, municipal and state officials, highway engineers, manufacturers and their distributors, educators, highway contractors, highway planners and Pan-American and European delegates.

Incidentally, the vacation touch will always be close at hand, with the Exposition on Treasure Island in the Bay!

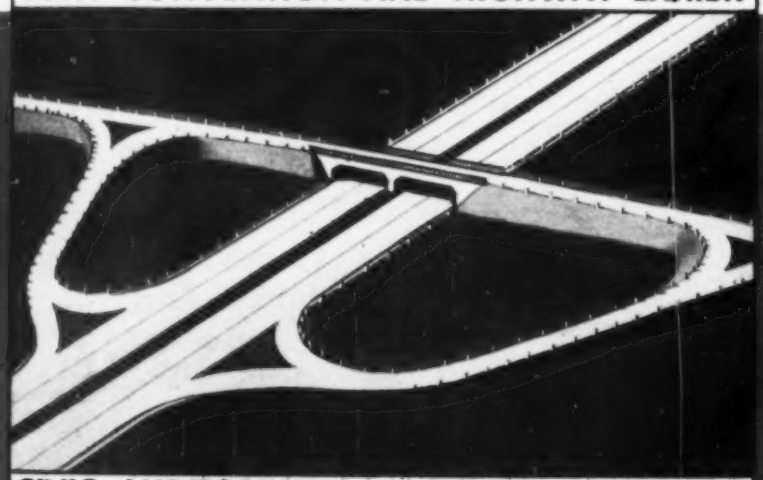
Put a ring around March 7, 8, 9, 10 on your calendar! Try your whistle on "California, Here I Come!"

Keep in step with America's traffic demands. Learn how to build the "highways of tomorrow"—learn how to maintain them!

Join the parade of highway progress!

Gather at Golden Gate!

HIGHWAYS OF TOMORROW
AMERICAN ROAD BUILDERS' ASSOCIATION
36TH CONVENTION AND HIGHWAY EXHIBIT



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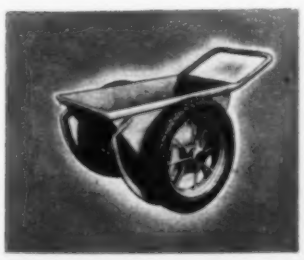

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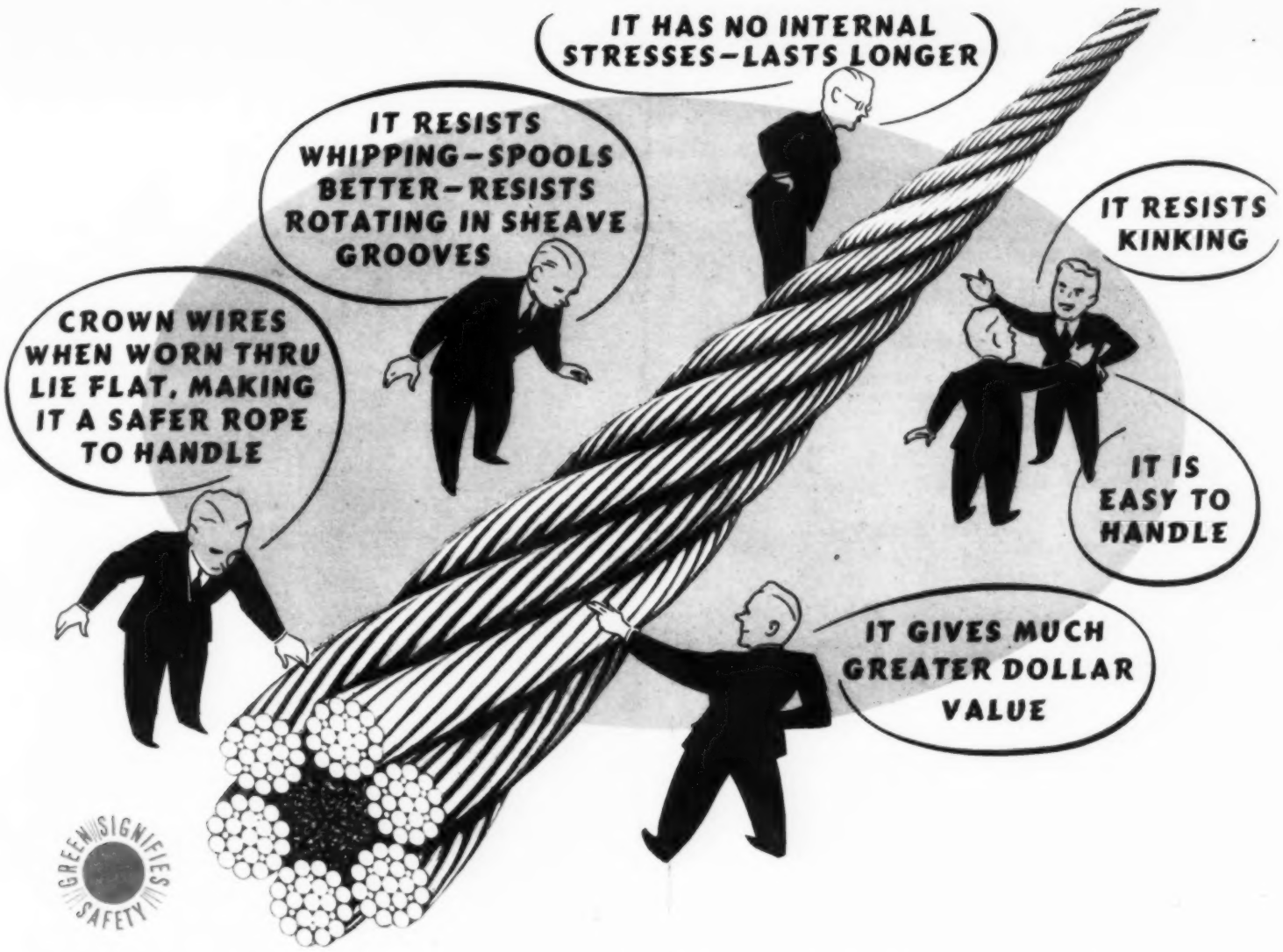
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